# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

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## Original Correspondence.

### COAL MINING IN THE COUNTY OF DURHAM.

...e Haswell, Shotton, and Easington Coal and Coke Company have ...r lease from different lessors about 7000 acres of royalty. This ...unded by the German Ocean on the east, and lies adjacent to ...royalties of Thornley, Ludworth, Littletown, Elemore, South ...on, and Murton Collieries. The coal measures under the Has... Shotton, and Easington properties, as well as the other col... ...s named, are overlaid by the magnesian limestone formation, ...rneath which is found the New Red Sandstone, of variable thick...

The magnesian limestone (and sandstone particularly) in the ...am coal field, are well known to present great difficulties in the ...ing of pits through them. These sinkings involve cutting through ... beds of limestone and piling through quicksand, where the ... is loose and shifting, from the action of water. The piles are ...n into the sand in successive lengths, one length within the ...r, until the whole depth is attained, requiring the pit to be of a ...sponding size at the outset. Powerful pumping-engines are re...d, as well as pumps and pump-rods, sinking engines, main ...s, ground crabs, blocks and ropes, buckets, and bucket leather—latter being quickly worn away in consequence of the action of large quantity of sand pumped up with the water. The pits are ...ly secured with cast-iron tubbing through these formations, ...ed up behind closely with wood or stone, the tubbing being ...ed at its joints, and of sufficient strength to withstand the pres... in accordance with the depth. On the property leased by the ...well, Shotton, and Easington Company there are two plants, ...-1. Haswell Pits, commenced in the year 1832, the first ship... ...of coal being on July 2, 1835, about twelve years subsequent to ...pening of Hetton Colliery.—2. Shotton Pits, situated 2760 yards ...-east from Haswell Pits, commenced sinking in the year 1841.

HASWELL COLLIERY.—Two pits are sunk to the Hutton seam; ...ngine-pit and downcast is 12 ft. in diameter, divided by brattice ... two parts, for pumps and coal work. The upcast, 40 yards ...-east of the downcast, is 9½ ft. in diameter, and is also used for ...ng coal. Where the tubbing was inserted in this pit, about ...ms. in depth, the diameter is 8¼ ft. only, owing to a new casing ...e-brick, 5 in. thick, a space of 1 in. being left between the tub... and brickwork. It should be observed that previous to fixing ... the site of the present pits two pits had been begun and aban...d on a site 845 yards north of them. The depth attained was ...t 50 fathoms; the sand under the magnesian limestone was ...t 17 fathoms in thickness. When one-half of the sand had been ...trated the feeders of water and the shifting nature of the quick... had become so formidable as to overpower the engines, and ...ed the abandonment of the undertaking, after an expenditure ...bout 60,000*l*. The strata sunk through in the present Haswell ...consist of—

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Fms. | ft. | in. |
| ...ial deposit | | | | | | 3 | 0 | 7 |
| ...y limestone | | | | | | 0 | 5 | 0 |
| ...w and brown magnesian limestone, with water | | | | | | 46 | 3 | 7 |
| ...metal | | | | | | 0 | 1 | 2 |
| ...sandstone—grey, red, & white, with beds of grey & blue marl. | | | | | | 14 | 2 | 0 |
| Measures.. | Coal seam | 2 ft. 5in. at | | | | 82 | 0 | 7 |
| | Three-quarter seam—Coal .. 1ft. 8in. | | | | | | | |
| | Shale.. 0 4 | | | | | | | |
| | Coal .. 0 2 | | | | | | | |
| | Shale.. 0 2 | | | | | | | |
| | Coal .. 1 8 = 4 | 0 | at | 89 | 4 | 11 | | |
| | Five-quarter seam | 3 | 6 | at | 91 | 4 | 6 | |
| | Main coal | 3 | 3 | at | 108 | 0 | 7 | |
| | Low Main | 3 | 7 | at | 134 | 0 | 1 | |
| | Hutton seam—Good coal .. 4 1 | | | | | | | |
| | Coarse coal.. 1 4 = 5 | 5 | at | 153 | 5 | 0 | | |

...e difficulties in sinking these pits were much less than in the ...attempt; the sandstone was hard, and gave out comparatively ... water. The pits were rendered perfectly dry by the insertion ...out 70 fms. of cast-iron tubbing in each pit, where the lime... and sandstone were passed through. Three engines were erected ...umping during the sinking of the pits, viz.—one pumping beam... ...e, and two winding-engines, adapted for pumping also. The ...ing-engine is a Boulton and Watt double-acting beam-engine, ...ged with two beams, and is a type of others in this district ...ing from great depths. The cylinder is 68½ in., 7 ft. stroke, ... steam-pressure, condensing. The main beam rests on the ... wall of the house, the smaller beam on the back wall, and from ... four bucket-lifts are worked. The lowest lift from the out end ...e main beam (in the pit) is 12 in. in diameter, 50 fathoms in ...h; the second is 15 in., the third 16¾ in. in diameter, each 36 fms. ...gth. These two lifts are worked from the cylinder end of the ... by a diagonal rod and a V-bob, about 20 fms. down the pit. ...ourth, or top lift, placed in a staple at the back of the engine, ...fathoms in length, and is worked from the out end of the back ...

There are two 18-in. pumps with this lift, both delivering at ...rface. The stroke in the pumps is 6 ft. in each lift. The en... goes four strokes per minute day and night; it is supplied with ... from four plain, round-ended boilers, 30 ft. by 8 feet. The ...ing-engines are placed between the pits; that for the engine-... a 32-in. vertical cylinder, 6-ft. stroke, non-condensing, direct ...g up to the drums, cast-iron levers—the front lever is extended ...gh the house as a beam, and was connected to the pumping ...ratus used while sinking (now removed). Flat wire-rope drums ...ed, 13 ft. 9 in. in diameter. The drums and fly-wheel rest on ...ide wall of the house and an intermediate wood framework. ...winding-engine at the Little Pit has a 31-in. cylinder, and is ...ar in other respects to that at the engine-pit. Each engine is ...shed with a dial indicator and a foot-break, the break-strap ...g on the under half of the fly-wheel. Six plain boilers supply ...n for both engines. These winding-engines may be taken to be ...e of most of the engines made for raising coal in this county ...years ago, and to the present time, with plain cast-iron levers, ...e levers are in some cases modified, to adapt the engines for ...ing as well as raising coal. There is no doubt the double-...der vertical engine is a great improvement upon the old form, ...ese are unknown in this district—engines with double hori...l cylinders have been latterly adopted in a few instances. In ...gine-pit the cages run on wood conductors; they are three-..., each carrying three 8½-cwt. tubs. In the little pit the cages ...o-decked, holding two tubs; each runs on four wire-rope guides. ...ple, 18 fms. in depth, is sunk by the side of each engine-house, ...in the counterbalance chain works down and up with each lift of the engine. There are five screens and an elevator for screening small coal at each pit.

The Hutton seam has furnished for thirty-five years the well-known Haswell Wallsend. It has been worked entirely on the bord and pillar system. The dip of the measures is nearly east 1 in 24. The pillars have been, to a great extent, removed, either closely following the bord workings, or after they have been for some time reserved. The principal cleavage runs north 45 west or south 45 east, and the bords have been driven in panels of ten or more, chiefly in direction at right angles to it, south-west or north-east. An engine-plane is still in operation; it proceeds eastward to a fault, rising 30 yards east; it then turns to north-east, and afterwards to east, its total length being 3 miles. The plane is worked by main and tail ropes; 50 tubs are run together. The engine—placed near the bottom of the engine-pit—has one vertical cylinder, 25½ in. in diameter, 4½ ft. stroke, and one 30-in. horizontal cylinder, 3½ ft. stroke, connected together on second motion. The boilers are underground. The engine has brought coal from three intermediate points, by means of sidings at each place, and in one case by knocking off the tail-rope, and running the wagons into a dip and up again with the main rope; at present coal is brought from the extremity of the plane only. A pumping-engine—placed near the hauling-engine—with a 9-in. horizontal cylinder, 18-in. stroke, pumps from 1000 yards down the plane, in two lifts, with 9-in. buckets, and rods running on rollers. A whin-dyke has been driven through in this seam, on the south of the pit; the thickness of whin is 21 yards 2 in., and of cinder or charred coal on each side of it 28 yards. This is believed to be the junction of the Hett dyke and another, which its great breadth and a division in the middle of it seems to substantiate. The Five-quarter, Main coal, and Low Main seams are also worked at this colliery; the area of working in them is small in comparison with the Hutton seam. The Five-quarter seam averages 3 ft. 6 in. of coal of fine quality; it has been worked on the bord and pillar system, and more extensively on what is termed here the long wall system. The principle of the latter is that a set of six, eight, or more "lifts" are driven on the face, 10 yards in breadth, one in advance of the other. A gate-road is formed in each lift, supported by loose material and chocks; cross-roads are formed at intervals. The main cleavage is the same in this as in the other seams, running north 45 west or south 45 east. The Main coal averages 3 ft. 2 in. in thickness, and is in course of being opened out and partially worked at different points. The Low Main averages 3 ft. 4 in. in thickness, and has been worked on the ordinary bord and pillar method. It is now got entirely by the long-wall or lift system. A set of gate-ways are driven in the solid coal, narrow, parallel with the cleavage, and 30 yards or more apart. From these the lifts, 10 yards wide, are driven 15 yards on each side, on the face—that is, south-west and north-east; cross-roads are made every 50 or 60 yards. Pack-walls, 10 ft. in width, are built on each side of the main road or mother-gate, and 6 ft. in width in the other gate-roads. The mother-gates can be extended to a long distance, as they are found to stand with little trouble after the falls have become consolidated. Powder is used in working the Five-quarter and Low Main seams. The effect of the long-wall system is to bring pressure on the face of the coal, which facilitates the labour of the workman. This is especially the case with hard coals, and when fresh and larger coal is produced than was got by the old method the advantage to the owner is as important, and will often affect materially the question of cost. The method of working in the Five-quarter seam must be carried on to a disadvantage, as there is an absence of stone for building pack-walls—at least, it is not made use of; this augurs well for the more general introduction of wide work, since it can be carried out without regular pack-walls, good stone for building those walls being considered essential towards making the system successful. The ventilation of the Haswell Mines is caused by two furnaces, each 8 ft. square, placed in the Hutton seam. The air in circulation amounts to 186,000 cubic feet per minute, 69,000 of which is supplied to the workings of the Hutton seam. The other engines on the surface at Haswell comprise a wagon hauling-engine, 31-in. cylinder, of the same form as the winding-engines. It has one drum and round wire-rope, and draws the laden wagons from the pit up an incline, 800 yards in length, to the engine; from thence the wagons run down with the rope to Fallowfield, an incline of 1760 yards. The empty wagons are drawn the contrary way, and descend to the pit with the same rope. An engine, with 8-in. cylinder, 16-in. stroke, works machinery for washing coal. A 13½-in. cylinder, 2-ft. stroke, works circular saws. A 6½-in. cylinder, 16½-in. stroke is used for chopping hay.

SHOTTON COLLIERY.—The operations at Shotton include coal working, coke-making, and fire-brick manufacture. There are two pits sunk to the Harvey seam, 14 ft. 9 in. in diameter; the south pit is the downcast, and is divided by brattice into two, for pumps and coal work. The upcast pit is 44 yards north of the engine-pit; the depth is 201 fms. to the Harvey seam; the Hutton seam lies 15 fms. above it. The thickness of magnesian limestone met with in sinking was similar to that at Haswell; the sandstone was 11 fms. in thickness. The pits were sunk through these formations without any great difficulties, as the sandstone was not associated with a large quantity of water. Tubbing, to the extent of 60 fms., is inserted in each pit, that in the upcast being cased with fire-brick. The pumping-engine is a double-acting one, with two cast-iron beams, 50-in. cylinder, 7-ft. stroke, 15 lbs. steam-pressure, condensing. It raises water from the Five-quarter seam, depth 138 fms., in four bucket-lifts, each of which is 34½ fms. in length. The lowest, from the end of the main beam, is 12 in.; the second and third, worked from a diagonal rod and V-bob, are 14½ in. and 14¾ in. respectively; the fourth, or top lift is 15½ in. bucket, placed in a staple behind the house, and worked from the end of the back beam. The stroke in the pumps is 6 feet. The winding-engines are placed between the pits, each has a 53-in. vertical cylinder, 7-ft. stroke, condensing, and flat wire-rope drums. These engines are otherwise on the same principle as those at Haswell; one is fitted with a dial indicator, the other with a chain and bell. There are nine plain boilers for the three engines, 30 ft. by 8 feet. Three other boilers, high pressure, supplied an engine, with two 22-in. cylinders, in the Five-quarter seam, by pipes in the downcast—this is removed. The cages for the south pit are two-decked, holding four 8½-cwt. tubs, running on wood conductors; those in the north pit are three-decked, carrying three tubs, and run each on four wire-rope guides. A staple for the counterbalance chain, 30 fms. in depth, is sunk at the side of each engine-house; this depth enables a large wheel to be used, and gives corresponding assistance to the engine at starting. There are six screens and an inclined elevator to each pit—the latter are worked by the respective winding-engines. The Five-quarter seam has been extensively worked—at present the working is confined to the Low Main and Harvey seams. The Low Main is 3 ft. 6 in. in thickness—it produces good steam coal. The Harvey seam averages 3 ft. 4 in. in thickness, and produces excellent gas and coking coal. The seams are worked both by the bord and pillar and the long walls methods—principally the latter. The principal cleavage runs north 65 west or south 65 east; the bords, as a rule, are driven in the direction north 25 east or south 25 west, which is at right angles to the cleavage. The gate-roads in the wide work are from 30 to 40 yards apart, extended as far as 25 chains in length; the lifts, 8 to 10 yards wide, are driven in the same direction as the bords. The dip of the coal is 1 in 24 eastward. A hauling-engine is being placed in the Harvey seam—it has two 15 in. horizontal cylinders, 2 ft. stroke, on second motion; it will work an engine-plane, 1700 yards in length, in a south-east direction, with main and tail ropes; it will also force water from the Harvey to the Five-quarter seam with two 4-in. rams and 8-in. pipes.

There are four ventilating-furnaces, placed at the bottom of a staple in the Harvey seam, which reaches to the Five-quarter seam, 72 fms. above. Two of the furnaces are 12 ft. square, and two are 8 ft. square. The quantity of air in circulation is 250,000 cubic feet per minute, 150,000 of which circulates through the workings of the Harvey seam alone. On large quantities of air mainly rest the greater safety of modern ventilation, obtained by ventilating power and large air-ways. Other measures are required to ensure safety—its skilful distribution into every part of the mine, well-constructed doors and stoppings, to which may be added the exclusive use of lamps and the prohibition of powder.

There are 260 coke-ovens erected at Shotton, of various plans, principally the 11-feet dome shape. About one-fourth of them are in operation. Some are connected in sets of four by flues to a short chimney; others are connected by flues to a chimney in sets of about 20. The coal used for coke making is washed. The coal-washer is an inclined trough, 33 ft. by 3 ft., having a vibratory motion, to facilitate the movement of material downwards; stops are placed at intervals, to intercept the stone and dirt. There are two troughs and an elevator, worked by a 15-inch beam-engine. The machine is capable of washing 200 tons of moderate coal per day.

Fire-bricks are manufactured here from the thill of the Low Main and Harvey seams. A horizontal steam-engine crushes the clay, elevates, and mixes with water ready for moulding. About 10,000 bricks per day can be made.

Two locomotive engines are employed on the Shotton branches. Coal may be conveyed by rail and shipped at the ports of Sunderland, Seaham, or Hartlepool from both collieries. The output of coal at Haswell Pits is about 1450 tons, and from Shotton Pits about 1000 tons per day, which is intended to be increased to 1600 tons per day

### THE TRUCK SYSTEM.

SIR,—From the evidence just given before the Truck Commission, at Glasgow, few outside the pale of the works where the system has so long been established will have been at all aware of its peculiarities and ramifications. It would appear that, besides having to pay a high price for inferior goods, the workman, if he wished to obtain any money more frequently than once a month, at least, had to pay from 1*s.* in 1*l.* upwards for the advance. Such a mode of levying on the wages of the men was not only an injustice to them, but was also most unfair and disadvantageous to those coalowners and iron-makers who paid their workpeople their earnings in cash every fortnight. As an instance of how large profits have been made out of the workmen by means of the store-shop and the advances, the manager at one establishment stated that the total amount paid for wages for the year ending Whit-Sunday, 1869, was 79,804*l.* 15*s.* 9*d.* The total amount *advanced* to workmen was 41,704*l.* 7*s.* 7*d.*, which shows 52·25 per cent. advanced of the total wages. The amount of advances spent in the store for the year was 22,958*l.*, or 55·05 per cent.

There are other modes by which the workmen lose part of their wages even less defensible than the advance system and the store. There is a most extraordinary practice carried on at the Monkland Works, and which will sound new and startling to the English masters and their workmen. Mr. Fernie, the manager, stated that there were collected in "off-takes" for the schools about 1000*l.* a-year, and there was also 884*l.* odd collected for medical purposes. In some cases the "off-take" was 8d., and in others 6d., for the medical man With regard to schools, "*the man who has no children pays half the sum levied* on others for school purposes." That the system will be tolerated no longer than the assembling of Parliament admits of no doubt, at least so far as legislation can put down a practice fraught with so much injustice to a large number of workmen in Scotland, and to those employers who have not resisted the practice of compelling their workmen to purchase provisions at the stores, for which they have to pay from 20 to 30 per cent. more than their actual value, and to pay at the rate of from 80 to 90 per cent. per annum for cash advances.

That I have by no means overstated the facts will be seen from the following extract from the evidence. With regard to the advance system, combined with the store, here is a fair sample of the statements made :—

James Muir, examined by Mr. Sellar, said—I have been employed for the last nineteen years at Summerlee, but have only held my present situation for fifteen months. If a man in the work earns 5*s.* to-day, he will perhaps get an advance of 4*s.* to-morrow. Advances are given once a week, twice a week, and sometimes every day. A man who receives an advance is expected to leave 75 per cent. of it in the store. If he does not do so, he is refused his advance the next time he applies—that is to say, if he is in the habit of taking away the whole of the money.

It would thus appear that at the least three-fourths of the wages received by the men are expected to be spent at the masters' stores. As to the quality of the articles sold, one of the witnesses stated that he could save, as a rule, 4*s.* in the pound by going to the ordinary shops. A Miss Miller, a lady who visited the families of a number of colliers in Lanarkshire, with the view of investigating the effect the stores had on their domestic condition, said she had seen the goods obtained from the stores, and found them generally inferior in quality, or too dear. In some instances men deposed that they had been compelled to leave their employ in consequence of not dealing at the shops provided by their employers.

Looking at these facts, there does not appear to have been any at-

tempt at what may be called evading the Truck Act; everything appears to have been done quite openly. There are, however, a few instances in which the work was done in a more indirect manner. The Glasgow Iron Company, it was stated by the managing partner, had a store at Motherwell which was let for 650*l.* a year. Besides that, however, the cashier or manager of the works stopped the money due to the storekeeper from the men's wages, for which he received 5 per cent. Ultimately, however, the company took 4 per cent., and left the manager 1 per cent.

Another hardship complained of in connection with the Truck system is the "off-takes" for the support of schools. At many of the works numbers of the men are Roman Catholics, and do not send their children to the schools which they are compelled to support, and which in many instances were more than self-supporting. One is also at a loss to conceive upon what ground a man who has no children should be compelled to maintain a school in which he has not the slightest interest. We certainly feel assured that neither the system of payments in force at the works in some parts of Scotland, nor yet the stoppages, would at the present time be tolerated in any part of England, and why they have been so long allowed to exist in the former part of the kingdom is by no means clear. Opposed as I have ever been to the unreasonable demands of workmen, more especially to combinations which would enforce by numbers and agitation what was unjust and unreasonable, I do think that a large body of the working classes in Scotland have a grievance, and one of a very oppressive character, which is not only injurious to them, but to employers of labour who pay wages in cash. I have no fear but the result of the Commission will be the putting down of a system which is opposed to all our ideas of what is fair between employers and employed.—*Glasgow, Sept.* 14. MENTOR.

## THE GREAT WESTERN MARITIME SHIP CANAL.

SIR,—The letter from your correspondent "K.," of Portsmouth, which appeared in the *Mining Journal* of Aug. 27, challenges some comments at my hands, which I shall be glad if you will insert.

It is generally admitted, as you yourself have observed, that the construction of the proposed canal would do much to open up an enlarged market for Welsh coal to the counties lying south of the Thames, and no doubt the Cornish mines would share in this advantage of obtaining fuel at greatly reduced prices, and there would also be effected a more economical and expeditious carriage of the ore to the smelting works in South Wales.

I need not here dilate on the other commercial results of the canal, as they are already sufficiently known, but as to the origin of the scheme, I must do justice to the memory of Mr. Telford, who designed the plans for a canal through the West of England, to which was given the name of "The English and Bristol Channels Ship Canal," and an Act of Parliament obtained for it in 1825. The project, however, fell through, not from engineering but financial difficulties, but doubtless the intention was to connect the two Channels by a ship canal, with harbours at each end. The dimensions are not given, but, judging from the estimated cost (1,750,000*l.*), they were probably not so large as those I have proposed.

When I introduced the subject of the Western Maritime Ship Canal, in October of last year, I was not aware of this prior scheme of Mr. Telford's; but the fact shows, at any rate, that such an enterprise had received the support of one of the first engineering names that this country has produced, who would not have committed himself to so great an undertaking without being assured of its practicability, in regard to levels, water supply, &c. Mr. Telford's route was from Bridgwater Bay at the north to Seaton Bay at the south, *via* Bridgwater, Chard, and Colyton. Mine is from the same point at the northern end to Exmouth Bight at the English Channel side, passing by Bridgwater, Taunton, and Exeter, both schemes directly connecting the two seas, and providing for harbours. My route is longer than Telford's, but the country is more continuously level, and better watered (great desiderata in the construction of canals), and my line will possibly be found the best, under all circumstances. But I am not wedded to my own idea, and if on accurate surveys any other course should be considered preferable, by all means let it be adopted.

With respect to the tonnage of coal passing through the canal, my figures were arrived at thus:—

| | | | |
|---|---|---|---|
| To ENGLISH COUNTIES—Cornwall | | Tons 184,661 | |
| | Devon | 389,686 | |
| | Dorset | 125,766 | |
| | Wilts | 83,151 | |
| | Hants | 320,396 | |
| | Sussex | 363,648 | |
| | Surrey, less metropolitan area | 83,735 | |
| | Kent ditto | 270,130 | |
| | Essex | 134,881 = | Tons 1,956,654 |
| To CHANNEL ISLANDS.. Jersey, Guernsey, &c. | | | 91,440 |
| | | Tons | 2,048,094 |
| To FRANCE | | | 714,669 |
| To LONDON DISTRICT (being one-half of the sea-borne coal in 1867, or one-fourth of the total supply by railway, sea, and canal) | | | 1,498,571 |
| Total tonnage | | | Tons 4,261,334 |

It will be seen by this statement that I agree with your correspondent in appropriating the bulk of the tonnage to the Southern and Western Counties and the Continent, and in giving the supply to London a somewhat subordinate place.

The levels of the two seas are singularly favourable to ensure a rapid passage from the out-ports of the coal districts to the South. The rise of the tide above the mean low level of spring tides being as follows:—

| | Springs. | Neaps. |
|---|---|---|
| Bridgwater Bar | Feet 35 | Feet 26½ |
| Exmouth | 12¼ | 8½ |

And making a comparison with the time occupied in the transit through the Suez Canal, which Capt. Chapman, in his description of that undertaking, states might be accomplished in 20 hours, I calculate that steamers will get from Cardiff to the southern mouth of the canal in about 15 hours, including stoppages, as against 36 to 40 hours, now taken in the voyage round Land's End. In the case of sailing vessels the saving will, of course, be much greater, especially in unfavourable weather.

I am unable to state absolutely the number of locks necessary, but very few would be required, the difference of level between the two extreme points being only 131 ft. The line of the canal can be reduced to a nominal gradient. But details of this kind can only be arrived at by a professional survey of the country, which cannot be set about until the requisite funds are furnished by persons interested in carrying through the project, for in a work of such general public utility no one individual can be expected to provide for the preliminary expenses from his own private resources. F. A. OWEN.

*City Carlton Club, London, E.C.*

## SIGNALLING BY MEANS OF ELECTRICITY.

SIR,—I read with a considerable amount of interest the article which appeared in a recent number of the Journal, in which Mr. Bailey's system of underground signalling is described, and I can bear ample testimony not only to the crude and laborious methods of signalling generally in vogue in most mining districts, but also to the superior advantages to be derived by bringing the aid of electrical science to bear upon this essential branch of mining.

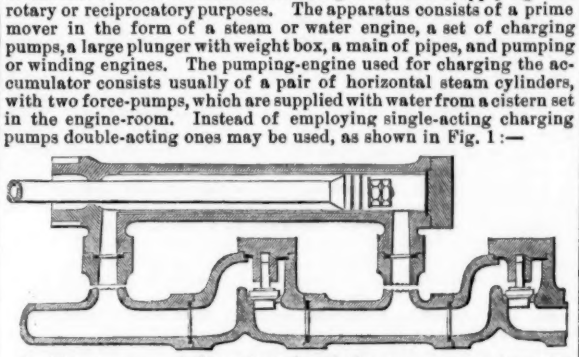
Some three or four years ago I first tried the electrical method practically, at a silver-lead mine in Cardiganshire, of which I had the supervision. It was necessary that we should send our ore stuff from the deep workings into an adit level, and as we had no available machine power within at least half a mile from the drawing-shaft, I ran a wire drawing rope over pulleys, in the usual way, from the winding-drum to the shaft, and by means of a simple but most efficient method of electrical signalling found it quite as easy and safe to land from that distance into the adit, where 3 or 4 feet of over-winding would have led to an accident, as it would be to draw from a shaft merely a few fathoms off. In this instance I diverged the conducting wires by extending one of them through my office, situated at some distance from the works, and by there connecting it with a tolerably large galvanometer every signal transmitted from the mine was simultaneously repeated at the galvanometer, the movement of the needle of which, whilst indicating the signals as they were sent and received, would give motion to another apparatus, registering, if required, the number of kibbles landed. I have since that time applied the method with the greatest success to other purposes in connection with mine signalling, &c.

I have tried various batteries, but have hithorto found Bunsen's arrangement to be the most economical and useful for the purpose. In this battery the outer cell contains dilute sulphuric acid, in which is immersed a circular amalgamated zinc plate, constituting the positive element, the negative element being a rod of carbon immersed in strong nitric acid contained in the inner or porous cell. Two or three cells of this battery are sufficient to signal up to a mile; it is, however, an easy matter to add cells to suit the distance and power of bell. The conducting-wires may be either of copper-wire or iron signal cord. The bell I use is the ordinary electro-magnetic alarum, worked by the direct action of the current which traverses the coil of insulated wire surrounding a soft iron bar in the instrument. As long as the electricity circulates through the wire the soft iron bar becomes magnetic, and by attracting an armature, at the end of which is attached a hammer, a rapid succession of blows are struck upon the bell for the length of time the current is made to pass. The battery and bell are fixed in the engine-room, whilst the lander at the opposite end is provided with a small lever, by raising which the conducting circuit is completed, battery contact is made, and the bell made to ring in accordance with any code of signals agreed upon. I am satisfied that the application of electrical signalling will enable that most useful institution, the wire-rope, to be employed in mining under circumstances which would otherwise preclude its use.

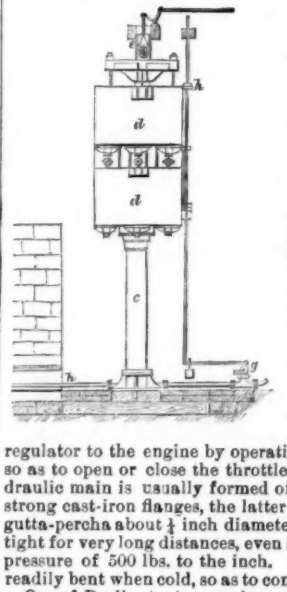
*Shrewsbury, Sept.* 13. EDWARD GLEDHILL.

## TRANSFER OF POWER—ACCUMULATOR SYSTEM.

This system furnishes the means of transferring from one point to another an accumulated amount of power, and of applying it to rotary or reciprocatory purposes. The apparatus consists of a prime mover in the form of a steam or water engine, a set of charging pumps, a large plunger with weight box, a main of pipes, and pumping or winding engines. The pumping-engine used for charging the accumulator consists usually of a pair of horizontal steam cylinders, with two force-pumps, which are supplied with water from a cistern set in the engine-room. Instead of employing single-acting charging pumps double-acting ones may be used, as shown in Fig. 1:—



In this arrangement the out-stroke of the pump causes the water contained in the annular space surrounding the plunger, *a*, to be forced into the pipes, while a further supply of water enters behind the piston, *b*, through the suction-valve, *d*; in the in-stroke, the water behind the piston is discharged through the delivery valve, *c*, and half passes around the annular space on the other side of the piston, while the remaining half is forced into the pipes, the area of the plunger, *a*, being half that of the pison, *b*. The large plunger and weight-box designated an accumulatort is exhibited in Fig. 2:—




*a*, cylinder with plunger; *b c*, loaded weight boxes; *d*, guide for ditto; *e*, pipe from pumping engine; *f*, pipe to hydraulic engines. The load upon the plunger is usually such as to give a pressure of from 300 to 500 lbs. per inch, whilst the case is made sufficiently capacious to contain the largest quantity of water which can be drawn from it at once by the simultaneous action of all the hydraulic machines with which it is connected. Whenever, also, the charging pumps force more water into the ram case than passes directly from it, the loaded plunger rises and makes room in the cylinder for the surplus: but when, on the other hand, the supply from the charging pumps is less than the quantity required, the plunger, with its load, descends, and makes up the deficiency out of store. The weighted plunger is also made to serve as a regulator to the engine by operating on a weight, which is arranged so as to open or close the throttle valve in the steam pipe. The hydraulic main is usually formed of wrought-iron pipes, screwed into strong cast-iron flanges, the latter recessed so as to receive a ring of gutta-percha about ¼ inch diameter. In this way joints are rendered tight for very long distances, even although subjected to a continuous pressure of 500 lbs. to the inch. Wrought-iron pipes may also be readily bent when cold, so as to conform to the variable line of a level.

One of Darlington's pumping-engines for draining winzes consists simply of a cylinder, a ram, two side rods, a bar-valve, two regulating cocks, and canti lever. The weight of a 2-in. ram engine, 3-ft. stroke, is about 90 lbs. The speed at which the engine may be driven is 16 strokes per minute, and under a pressure of 500 lbs. per square inch it is capable of working a pump 8 in. diameter 10 fathoms deep, or one of nearly 6 in. diameter 20 fathoms deep.

In the hydraulic main a constant pressure is maintained, and the momentum occasioned by the return of the stroke relieved by means of a lifting valve-lever and weight, similar to an ordinary safety-valve, but instead of a non-elastic connection between the lever and weight a spring is interposed, of sufficient elasticity to support the weight.

By this means the inertia of the weight is prevented from checking the sudden motion of the valve when acted on by the momentum transmitted through the water. Several advantages are offered by the accumulator system; as, for instance, mountain streams may be arrested, and applied to drive a wheel, the power compounded and transferred over broken or hilly ground. The transfer main may be of very small diameter, and sufficiently light to be fixed in the roof of a level. Winding and pumping-engines, with cylinders of small diameters, will occupy but little room, and exert a large amount of power. The friction of the water is inconsiderable, when compared with the greatness of pressure which may be used. Little or no water need be wasted in effecting the transfer of power, since it can be returned to the charging-pumps, and continually circulated. Inconvenience and nuisance arising from the use of underground steam-engines may be avoided, and all the advantages derivable from their use secured. Machinery of this class need suffer no derangement from frost, since all risk in this respect may be avoided by placing the apparatus in buildings, or below the surface of the ground; and in cases where this is impossible accidents can be prevented by letting out the water as soon as the machines are stopped.

X.

## MINING, IN OLD AND NEW DISTRICTS.

SIR,—It is quite true that no enterprise or pursuit has suffered more the last few years than that of mining in Great Britain for copper; and the result of the falling off in smelting operations in South Wales, as well as other important smelting districts in the North of England proves the fact. The trade is literally reduced to nothing, when compared to the business done in mining and smelting a few years ago in this country. The consumption of copper in Great Britain and France is about 100,000 tons of cake annually. The British empire at present produces about 5000 of metal only; formerly the average production of this article for many years was about 20,000 tons annually. Now, what is the cause of this great falling off in our production of one of the staple articles of several counties?—Ignorance on the part of the great landed proprietors in the first place, by not meeting the competition of the age.

There was a time when Great Britain nearly supplied Europe with copper, but new worlds have sprung into existence, and immense masses of copper have been found near the surface, of the highest percentage of metal in the ore. There can be no doubt that free trade has altered the local position of several districts in Great Britain, where industry and prosperity at one period flourished. High rents or royalties are the bane of industry and enterprise at present. Great Britain is not exhausted of its mineral treasures, but there are doubtless certain districts, after yielding millions sterling annually, which are now unable to meet the selling prices of the day. Encouragement should be given to capitalists who are desirous of promoting mining operations at home.

The merchant princes of England possess enormous tracts of land in new countries, and it is their interest to promote mining operations in their newly-acquired possessions to the utmost extent in their power. Tin and lead at present are the exceptions, but who knows what may be discovered at no distant period? About half a century ago Spain inundated Europe with lead ore for a time; more recently the islands of Banca and Billiton with tin; and what has occurred may occur again. From information I have received from practical authorities, who have travelled much of late years, the production of lead and tin ores is merely a matter of trial in developing great resourses of such minerals in various parts. We all know that the commercial value of every article is what it is worth. Doubtless the supply of copper, from various causes, has far exceeded the consumption of late years, hence the decline of about 40 per cent. in this article has been the result.

Old and nearly exhausted mines in every country must give way to new discoveries, as the expenses of working bear no comparison in the working charges of old and new mining pursuits. A difference of 30 to 50 per cent. in the working costs of a large undertaking tells seriously on the balance-sheet at the end of the year. Besides, the highest percentage of copper is found from 100 to 200 yds. from the surface, and but rarely at a greater depth. Exceptions may, and probably do, occur. A. BENNETT.

## "SCIENCE IN MINING."

SIR,—I notice in the Journal of Sept. 3 an attack on my letter by Charles Thomas and "C.," in which I am told that under the above heading I am endeavouring to puff off certain mines. Had they read my letter with a little more attention they must have seen that I only mentioned those mines in my first letter as illustrations of some that science has decidedly benefitted, while in further letters I propose to show how others have been improved, or re-worked, by the progress of science in modern days.

With respect to Old Treburgett Mine, I neither said nor meant to infer that improvements in machinery affected it more than many other mines, but what I did mean was that the cost and uncertainty of machinery in years gone by was one reason for its being stopped, the value of the silver ores and silver in the lead not being turned to account; so now the combination of improvements in machinery, metallurgy, and chemistry cause the Old Treburgett Mine to hold a high position as an illustration of what "Science in Mining" can effect. With respect to the questions these writers have put to me, I hope to reply to some of them in a future letter, as I contemplate an early visit to this interesting property: In the meantime, permit me to remind them of the old proverb, that "Fools may ask questions that the wisest cannot answer." I cordially agree with some of their remarks,—that few pursuits have benefitted so little from science, and that it is a disgrace that science has done so little for mining. Doubtless it will do more when mining becomes a more legitimate enterprise. I do not, however, see that this is any reason for captious individuals to endeavour to prevent scientific men from lightening their darkness. Quite the contrary; they ought to be all the more ready to learn.

I must be permitted to differ from Mr. Chas. Thomas in some of his remarks. "Mechanical Science" is "Science in Mining," and at present forms a great part of it, inasmuch as mining generally cannot be carried on without it. In this "C." seems to agree, as he calls it a palpable truism. Mr. Thomas, after wading through a curious combination of words, forming some nine lines, gives it as an illustration of his idea of "Science in Mining." Most of your readers will, however, doubtless take as many lines out of "Walker" in preference.

I thank these gentlemen for their advice, and when I want to extol any mine (which is not at all likely) will accept it, and apply to them for their opinion, which they are doubtless well able to give. As they have offered the humblest apology for their letters you, Sir, will doubtless accept it, with the rest of your readers, and allow them to retire. F. G. S.

## SCIENCE IN MINING, AND OLD TREBURGETT.

SIR,—I cannot for a moment pretend to climb to the scientific heights of Mr. Thomas. Not having the good fortune in my youth of being drilled in Pinnock's Catechisms or Joyce's Scientific Dialogues, I must confess that he has the advantage over me in the mysteries and mystifications of the enunciation of scientific principles,—*according to Thomas.* But while I contemplate his profundity with a feeling near akin to awe, I must, perforce, content myself with commonsense notions. Now, in due submission to his superior learning and authority, I would beg leave to state that science *in* mining and the science *of* mining are two very different things, and that he in his attack upon "F. G. S." has mistaken the one for the other. By "Science *in* mining" I understand *the appropriation of the results of science in mining operations*, whether it be of the science of chemistry or of mineralogy, to the determination of the character of minerals; or of mechanical science, to facilitating the work of gaining and extracting them. And this is what "F. G. S.'s" letter clearly expresses, and in both these respects I contend that Old Treburgett affords a striking illustration of the advantages of "Science *in* Mining." By its aid, quite apart from the science *of* mining, a mineral abounding in the Old Treburgett Mine, and which in its former working was thrown away as worthless, has now been proved to be very valuable—to be, in fact, a silver ore of great richness. And, further, the lead ore, which in its former working was sold at a low price, as pure lead only, has by the same aid been proved to be rich in silver, and to be worth three times the amount it was sold for: and yet the mine paid considerable profits, even under these unfavourable circumstances. This surely is a fair illustration of the advantages of "Science in Mining," and I doubt not a very satisfactory one to those interested in the re-working of Old Treburgett.

But, again, as regards the application of the results of mechanical science, the re-working of this mine affords a no less striking illustration of the benefits to be anticipated from "Science in Mining." This mine was abandoned when it had been worked to the comparatively shallow depth of 50 or 60 fms. only, not from any failure of mineral, but because the mechanical appliances then in use were not sufficient to keep the water under. But now, by the superior appliance of mechanical science in mining this difficulty is in process of being rapidly overcome; the unwatering of the mine is steadily advancing. It is confidently anticipated—and has, in fact, already been proved—that a large amount of the above-mentioned silver ore will be found standing entire on the sides of the old workings; that a large amount of unwrought backs will be found standing entire, with both silver and silver-lead ores untouched; and, further, the extra depth to which the workings may be carried will depend on the power applied for draining the mine of its water—in other words, on the aid of "Science in Mining." The engine lately erected will, it is believed, suffice for draining it to two or three times its present depth.

Now, Sir, I feel persuaded that both you and the readers of the Journal will agree with me that these advantages—the benefits of which the shareholders will, I trust, ere long be made sensible of—are due to the aid of "Science in Mining," and that this term has been rightly used by "F. G. S.," and fitly illustrated by the example of old Treburgett; and that the term is not, as Mr. Thomas, and also your monogrammatic correspondent, "C.," misunderstand it, equivalent to the "Science of Mining." The temper of "C.'s" communication, especially, is very bad, and seems to betray the existence of some active irritating cause. Is it that he has tried the tricks that he seems to suspect others of, and found them fail, and so feels angry and envious of the success of honest undertakings, that will bear the light and court investigation? If so, let him take a honest, straightforward course for the future, and he will find such courses promotive of good temper, and perchance also of success; but the latter result must depend upon the amount of judgment he is capable of exercising. T. L.

## SCIENCE IN MINING—OLD TREBURGETT.

SIR,—Under the above heading, in the Supplement to the *Mining Journal* of Sept. 3, some of your correspondents having expressed a wish for information respecting the work now being carried on at Old Treburgett, I am desired by the directors to inform those gentlemen, and others interested in silver ores, that the above mine is open to the inspection of visitors every Wednesday.

M. H. TILLY, Sec.

*Circus-place, Finsbury, Sept.* 14.

## MINING IN BRAZIL—THE TAQUARIL GOLD MINE.

SIR,—In the *Mining Journal* of Sept. 3 appeared an article, in which Capt. Pengilly's name, with several others, was brought prominently before the public in connection with the Taquaril Gold Mine, in Brazil, and if you will kindly afford me a small space in your valuable Journal for a few words in reply I should be exceedingly obliged.

Capt. Pengilly has written many reports, all favourable, on the Taquaril, but he does not remember the exact number of oitavas of gold he mentioned which a 12-head stamps would be capable of producing, admitting, however, the number stated in the Journal to be 320 oitavas. The Captain knew well at the same time that a 12-head stamps supplied from the shoot which he saw and left at the bottom, would produce three times that amount of gold in 24 hours. But if such a statement had been made in a report when the company was in course of formation it would have been looked upon as an exaggeration, put forth for the purpose only of obtaining money from the public for a worthless mine; so that Capt. Pengilly, by moderating his report, greatly assisted in obtaining for the Taquaril Company the richest gold mine in Brazil. The re-opening of the Taquaril old mine to the water level was soon reached, and the people now connected with the works there were told repeatedly in what direction to work, and they were also told to within 6 ft. where the gold now extracted was to be found, so that hitherto superior mining abilities have not been necessary, but in future the greatest mineralogical knowledge and mining

still procurable should be employed, and which will be necessary for the successful development of the mine.

The tardiness in getting the pumping-engine and stamping machinery to work can easily be accounted for by the frequent changes which have been made in the managers at the mine: new managers almost invariably carry new ideas, either good or bad, with them, and such new ideas are not always favourable to a mining, or any other company. The people seem now, however, to be doing all in their power.

The excavation on the great shoot in the under lode, mentioned in the Journal of Aug. 20, is over 30 ft. wide, so that as yet a small portion only of the riches the Taquaril lodes contain have been seen by the present workers. Besides, there are yet three other lodes untouched running parallel with, and lying directly under, the two already opened, which will be intersected almost immediately, and cut through by sinking the new engine-shaft, when more rich discoveries will, doubtless, be meet with. There is another range of lodes running in the same direction as those already mentioned, and only about 15 fms. apart, commencing from the bottom of the old engine-shaft northward, which are quite as likely to be rich as those now in operation. A BRAZILIAN MINER.

## THE TAQUARIL MINE, AND ITS MANAGEMENT.

SIR,—Encouraging statements and reports on the Taquaril Gold Mine continue to appear in the *Mining Journal*, and if you would kindly afford me space in your valuable paper for a word or so concerning that rich mine I should be exceedingly obliged. The report of July 15 last states that the company possesses one of the richest gold mines in Brazil. It might with much propriety have further stated the mine to be the richest, and if only worked with ordinary foresight and economy it would afford larger profits than any other gold mine now in course of working in that country. The re-opening of the mine was commenced to within a few days of two years ago. From that time to now a continual outlay has been going on, and it would be well if we could be informed how much longer this expenditure is likely to continue without some remunerative results. Samples taken by the ton, and pounded in a mortar, producing 30 or more ounces of gold to the ton, are sufficient evidence of the capabilities of the mine, and instead of a 12-head stamps, producing 320 ozts.=40 ozs. per day, which was alluded to in the Journal a week or so ago, my estimate, including box-work, is 144 ozs.=12 lbs. of gold per day. It may be said that a 12-head stamps cannot be supplied from the shoot the samples were taken from; but when the old excavation is cleared, so as to ascertain the full extent of the shoot, there will be no real obstacle in the way of supplying the stamps from it; and this, be it understood, alludes to the under lode only.

If the erection of a pumping-engine and stamps had been taken in hand and completed at the same time, there would not have been anything very new in it; it has been done before now, and might have been done at the Taquaril. Why the stamps have been neglected no reason has been assigned, but the heavy expenditure shows clearly enough that the company has not been limited in money. [As a guarantee of good faith I enclose my name.]

A SHAREHOLDER.

[ADVERTISEMENT.]

## FLORENCE AND TONKIN UNITED MINES.

SIR,—In handing you a report of the proceedings of a general meeting held on the mine this day, Sept. 9 (being the first general meeting), I beg to call your special attention to the report of the agent on the mine, together with that of Capt. Foote, of Trewetha and South Ward, who has been specially requested to inspect the mine. THOMAS VOSPER, Purser.

## FLORENCE AND TONKIN MINES.

### GENERAL MEETING, HELD SEPTEMBER 9, 1870.

E. NICOLLS, Esq., in the chair.

The notice convening the meeting was read. The agent's report was read, and ordered to be printed and circulated.

Resolved,—That a call of 1s. per share (640*l.*) be and is hereby made, payable to the bankers of the company; and that a discount of 5 per cent. be allowed on all calls paid before Oct. 7, 1870.

Resolved,—That Messrs. Dingley, Pethybridge, and Co., Callington, be the bankers of the company; and that all cheques be signed by two of the committee, and countersigned by the purser.

Resolved,—That Messrs. E. Nicolls and Peter Roberts (Callington), Adam Murray (London), T. Grenfell (Calstock), and James Pearce (Tavistock) be the committee of management.

Resolved,—That Mr. William Verran, of Callington, be the agent of the mine, at a salary of 7*l.* 7s. per month; and that T. Vosper be the purser, at a salary of 6*l.* 6s. per month.

The thanks of the meeting were tendered to the Chairman for his courteous conduct in the chair.

REPORTS.

*Sept.* 9.—In handing you a report for the meeting it will not be necessary to go into particulars as to the size of the sett and the number of the lodes and cross-courses traversing the same, as these are clearly stated in the prospectus. My remarks will refer principally to our present mode of working, and our prospects as regards the future. We are driving a level west from the bottom of Saw's shaft, 55 fms. from surface, by the side of the copper lode; the present end is in about 4 fms. from shaft, and we consider there will be nearly 30 fms. further to drive to reach the lead lode—a point to which we attach great importance, for reasons which will appear in this report when referring to shallow levels. The 45 west has been driven about 26 fms. from Saw's shaft, and is, most probably, within 4 or 5 fms. of cutting the lead lode; here, also, we are driving by the side of the copper lode, for the purpose of reaching the lead lode as quickly as possible. The 35 has been extended west from Saw's shaft over 80 fms., and about 30 fms. west of the lead lode there is a very compact and promising lode, containing ore and mundic. We are now preparing to lay a tramroad in this level, and shall resume the drivage immediately with the all but absolute certainty of soon entering on a long run of very productive ground. In this level—the 35—we have commenced to drive south on the course of the lead lode, and are in from 3 to 4 fms. from the copper lode, at which point we have quantities of sulphurous mundic, intermixed with lime and quartz of the best description, and fine spots of silver-lead ore, which promise well to the long run of ground to the south, under the mass of splendid gossan seen at surface; the indications of this short drivage at this level warrant the anticipations of prosperous results at deeper levels, and cause us to attach importance to cutting the lead lode at the 45 and 55. We have commenced sinking a winze at the bottom of the deep adit level, about 10 fms. in advance of the western end at the 35, and have to report a gradual improvement in the character of the lodes. This winze is down nearly 4 fms., and the lode is now worth from 2 to 3 tons of copper ore per fathom, with every promise of opening up a very valuable piece of mining ground, which is likely to continue west to Holmbush great cross-course, about 120 fathoms. Looking at the prospects in the western part of the mine for copper and lead, and the certainty of tin in the Tonkin, or eastern part, with so much of the heavy work—such as sinking shafts, &c.—already done, I consider we are justified in looking for speedy and permanent success, such as shall amply reward the shareholders, and be a great boon to the neighbourhood.—WILLIAM VERRAN.

*Sept.* 9.—I have this day intpected this property, and beg to hand you my report. Saw's shaft is sunk to the depth of 55 fathoms. At this depth the lode is come into the shaft, and at present the operation is confined to driving west, which is extended about 4 fathoms. The lode at this point is being intersected by a cross-course. The great object is to drive this level with all possible speed to the lead lode, which I would strongly recommend. At the 45 west the driving is by the side of the copper lode, so as to reach the lead lode as soon as possible, and which is calculated to be reached in about 4 fms. further driving, and, as the ground is favourable, this object will soon be reached, and, no doubt, the copper lode will improve after passing the lead lode. There is a pitch working in the back of this level, east of Saw's shaft, the same producing good work. It would appear that some change has taken place in the underlie at or about this point—the main part of the lode underlies south, while, at the same time, the ore-bearing part of the same is underlying north, which makes it appear as another lode. At the 35 driving is being pushed on with all speed; on the lead lode south—a very important point—this drivage is in about 3½ fms. from the copper lode, and is producing good stones of lead, with lime, horn-spar, &c., in fact all that can be expected so near the copper lode, and, looking at the fine gossan at the back, there is no fear of this lode being a very valuable one in the falling ground to the south. I would strongly recommend that this level be driven west as soon as possible, and am pleased to see preparations being made by cutting ground for laying tramroad, &c. A decided change has taken place in the lode within the last few feet driving, before it was suspended. A winze has been sunk in the bottom of the deep adit, about 10 fms. in advance of the 35 west; as fine a looking lode as can be seen is in this winze, and will produce from 2 to 3 tons per fathom; and by driving the 35 I am fully persuaded large quantities of copper ore will be laid open between this point and the Holmbush great cross-course. In conclusion, I would strongly recommend pushing all the levels west of Saw's shaft for copper, the 35 south for lead, and the 45 south as soon as the lead lode is reached, as by so doing I am fully persuaded this will prove a good and lasting property.—THOMAS FOOTE.

## NORTHERN SILVER-LEAD AND BLENDE MINING CO.

SIR,—Your correspondent, "Subscriber," can obtain the information he asks for by reference to the Journal and Supplement of Aug. 13. In the letter on "Mining in the Isle of Man" is a description of the position and prospects of the property, and at page 675 of the same issue will be found the manager's report on the mine, dated Aug. 8, as submitted to the shareholders at their first general meeting. Should any further particulars be required they will be furnished on application at the company's office. THE SECRETARY.

*Abchurch-chambers, City.*

## THE QUEEN MINE.

SIR,—I am a constant reader of your Journal, and have both won and lost large sums of money in mining. I have some shares in the Queen Mine, and am delighted to receive so early a dividend, and such a good account of the property; but would ask Capt. Knott, through your columns, what he means by silver ore of moderate quality? Mr. Barnard informs me by private correspondence that moderate quality is from 100 to 200 ozs. of silver to the ton. I should like to have Capt. Knott's reply in public print, and, at the same time, he may, perhaps, be kind enough to let me know what he calls rich silver ore, and the weight of a bag of silver ore. It seems more like a dream than a reality for a mine to be started, and actually pay out of profits a dividend in less than three months. It is now three months since I bought 100 shares, at 1*l.* each. I have paid two calls—in all 50*l.*—and have already received a dividend of 5*l.*; this is after the rate of 40 per cent. per annum, and I am told that the steam-engine is not yet started, and that my shares will most likely realise me 20*l.* each in six months time, as the mine has not yet made a fair start; and Captain Knott openly declares that he will be able to get ready for market 500 tons of copper and mundic per month.

I am, so far, money out of pocket by Mr. Barnard's Virtuous Lady, but I have every confidence that things will turn out as he says, and I have to thank him heartily for introducing the Queen to my notice. SHAREHOLDER.

[For remainder of Original Correspondence see to-day's Journal.]

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending September 11 was 9455*l.* 8s. 10d.

## THE IRON AND STEEL INSTITUTE.

### THE PLYMOUTH IRON WORKS.

A special train conveyed the members of the Institute and the visitors, about 200 in number, from the station of the Great Western Railway over the private railway of the Plymouth Company to the Plymouth Works. The party, led by Mr. Fothergill and the President of the Institute, the Duke of Devonshire, went over the blast-furnaces, examined the Pentrebach finishing establishment, and witnessed the results of the labour and skill of the owners and staff of the Plymouth Company. A short sketch of the works will enable the reader to realise what the visitors saw. These works are situated south of Merthyr, and are to be seen on the right-hand side whilst travelling by rail from Troedyrhiw to Merthyr. They were purchased seven years ago of the executors of the late Mr. Anthony Hill, by Messrs. Richard Fothergill, M.P., and T. A. Hankey, the present owners. They consist of four separate works—Plymouth, Pentrebach, and Dyffryn, for Pennydarren may now be considered part of the Plymouth Works. These works, taken together, are very considerable, and give employment to a large number of hands.

Plymouth consists of five cold-blast furnaces, three only of which are now at work, with one 90-in. horizontal blowing-engine, and two water-wheels driving four 66-in. cylinders. The iron used in the manufacture of the Great Eastern S.G. cable, that stood the great storm off Holyhead, was made at these works.

Pentrebach is situated about a mile below Plymouth, at a sufficiently lower level for the diameter of the water-wheels which assist in driving the extensive forges and mills. This is the manufacturing division of the works, and consists of four forges, with the necessary trains and steam-hammers, two rail-mills, two No. 2 mills, and a small bar-iron mill. Two small bar-mills and a slitting mill is now idle, the whole force of the establishment being directed to the manufacture of rails. These works are conducted with great energy and skill, Mr. Fothergill taking an active part in the management, assisted by his able and indefatigable engineer, Mr. Hosgood. We were told that the mills now at work rolled upwards of 1000 tons of manufactured iron in the course of last week. They are capable of rolling bars from 6 in. square, of ordinary lengths, down to slitting, and 3-16 in. guide-iron.

Dyffryn consists of five blast-furnaces, four of which are now at work—three on cold and one on hot-blast. There are two blowing engines, with cylinders of 90 and 122 inches in diameter, and four 60-in. cylinders driven by two water-wheels, with refineries and coke ovens. The coke chiefly used at the blast-furnaces is the open air coke, made from the best steam coal, which is very free from sulphur. Penydarren Works, situated just above the town, were formerly owned and managed by the late Mr. Forman. They were at one time very extensive works, but of late years have been quite idle, the great furnaces and sheds silent, gloomy, and deserted. They are now the freehold property of the Plymouth Iron Company, and getting into work again. One of the forges started a few weeks ago, and a second is nearly ready. These works consist of seven blast-furnaces, four refineries, two large blast-engines, with blowing cylinders, 104 and 122 in. respectiveey, and two forges, with the necessary furnaces. The blasting-engines are now being thoroughly repaired, one of which, with four refineries, will start in a few days, whilst the other, with two blast-furnaces are being proceeded with. There is a number of locomotive engines used about these works, several of which are 2 ft. 8 in. gauge, which very materially lessen the cost of transmitting the raw material and manufactured iron from one place to another.

### PLYMOUTH COLLIERIES.

In connection with the iron works are six collieries, yielding on an average 1500 tons per day. There are at the South Dyffryn pits an immense pumping engine, and a pair of gigantic moving engines of Cornish manufacture. These, for want of time, the visitors were unable to see yesterday. The collieries are under the management of Mr. John Smith, one of the ablest, most successful, and least pretending of the many able mineral engineers of the district. Mr. Smith is also manager of the extensive collieries of the Aberdare Iron Company, in the Aberdare Valley.

### THE ABERDARE IRON WORKS.

These works, situated in the valley of Aberdare, consist of the Llwydcoed Blast-Furnaces, Abernant Blast-Furnaces, Forges, and Mills, and the Taff Vale Works, at Treforest, near Pontypridd, and are under the sole management of Mr. Fothergill, M.P. Much, however, of the local management, since the hon. gentleman has become Member of Parliament, devolves upon Mr. Hosgood, the chief engineer of the company.

The Llwydcoed Furnaces—two of which are at work and one idle—are considered some of the best in Wales. We were told lately that one of them made 536 tons of pig-iron in one week, and often keeps up close to this quantity. The hot-blast is very good here, coming up close to 900. There are a great number of coke ovens at these works, and the quantity of coke used to make a ton of iron is very moderate. There are two blast-furnaces at work at Abernant, on much the same principle as at Llwydcoed. The furnaces are not high, and seem very much like other furnaces in the neighbourhood. There are also refineries here, as well as smithies and carpenters' shops. The forges consist of four trains, with the necessary furnaces, steam hammers, and rolls. There are two mills, one of which was rolling some of the largest sized rails extant—80 lbs. to the yard—and seemed to be turning out at the rate of over 80 tons a turn with ease and regularity. The other is a smaller mill, used for making fish-plates and bar-iron. The mills at Treforest, known as the Taff Vale Works, are used for rails only, and often turn out 800 tons weekly of finished rails. There are a number of smaller engines at work at these mills, and each machine worked by its separate engine.

### THE CYFARTHFA COLLIERIES.

After leaving the Plymouth Works the party proceeded by rail to Troedyrhiw, and then walked up the opposite hill to the Castle Pit, the property of Mr. Crawshay. The pit was recently sunk at a cost of 30,000*l.*, and is considered one of the finest in South Wales. It is 330 yards deep, and cased from top to bottom with brick and cement. It is worked with powerful engines, constructed by Mr. Pearce, the engineer of the Cyfarthfa Works, and was the admiration of all the visitors, who swarmed over the rooms and galleries, examining the character and workings of these splendid engines.

### THE CYFARTHFA WORKS.

Another train, which had been provided for the occasion, took the party to the Cyfarthfa Works, over which the party spread themselves, observing the construction of the works, and the various processes of iron manufacture. Mr. W. Crawshay conducted the President and visitors through the works.

These magnificent and model works are supposed to be the finest in the kingdom, and are the property of Mr. Robert Thompson Crawshay, of Cyfarthfa Castle. They consist of Cyfarthfa and Ynysfach, the latter about ½ mile below the former, with the Glamorganshire Canal passing close to and in direct communication with it. Ynysfach is a feeder of the greater works. Cyfarthfa Works has 11 blast-furnaces, 9 of which are now working, 80 puddling-furnaces, 12 refineries, and 6 mills. Everything is so arranged and utilised about these works that the arrangements may be considered perfect. The Taff River passes through the works, the waters of which, after turning the immense water-wheels of the works, pass into the canal, which is almost the exclusive property of the princely owner of the works.

One very noticeable feature about these works is the large quantity of iron, in various stages of manufacture, stacked in the form of military hats in the yard. There were upwards of 20,000 tons of "puddled bars" alone seen on the ground yesterday. Large stocks of mine and ore are also stored around the walls.

The old feudal principle is retained to a greater degree at the Cyfarthfa Works than any other that we know. Although the Crawshays brook no control, and are absolute lords of their domains, there is attachment existing between master and men which is wanting elsewhere. Whether this is due to old traditions or a different method of government, it is not for us to enquire, but it is a noticeable fact that there is a larger number of workmen, sons, and grandsons, and great-grandsons of men who worked at Cyfarthfa in the halcyon days of Richard and William Crawshay than in any other iron works in this part of the kingdom. For this reason strikes and threats of strikes are less frequent than in more modern establishments. As an illustration of what men will do when animated with a desire to please, the following paragraph, copied from the *Merthyr Star*, of March 19, 1857, is in point:—

"EXTRAORDINARY MAKE OF RAILS AT CYFARTHFA IRON WORKS.—We are credibly informed that a rolling-mill, consisting of only one pair of rolls, at the above works, turned out the extraordinary quantity of 1002 tons of marketable rails, in the week ending May 12, and that in 11 turns of 12 hours each! In two days they rolled above 100 tons each day, and that being heated by 14 balling-furnaces only—a fact almost incredible, and which is unsurpassed in the annals of iron manufacture. Great credit is due to the experienced and talented mill manager, Mr. Tracey Rees, for his admirable arrangements to produce such an extraordinary result, and to the workmen for their exertions in the arduous undertaking. Doubtless their services are duly appreciated by their employer. And the following copy of a letter from the owner of the works to the mill manager is characteristic of the good feeling existing between master and men:—'TRACEY REES: I send you for this night's supper a leg of lamb and a bottle of champagne, to commemorate the making of 1002 tons of finished rails in 11 12-hour turns, with 14 furnaces; a feat which I believe has never been performed before, and which throws great credit on you and all the men concerned.—ROBERT T. CRAWSHAY, Cyfarthfa, March 12, 1869.'"

### THE DOWLAIS IRON WORKS.

The first object which drew the attention of the visitors, and seemed to create great interest, was the working of the patent known as "Blair's Rotatory Puddling Process," the object of which is to improve the process of puddling, by which the iron may be rolled into bars at once. There is a conflict of opinion among practical men about this process, but its inventor is sanguine of its success. After walking through these rolling-mills, and witnessing the improved blowing process, which was observed with much interest, the party proceeded to the old works, passing a number of blast-furnaces situated in a semi-circular hollow, through which we walked as fast as we could, on account of the quantity of gas with which the atmosphere was charged. We then went over tramroads, shale tips, and heaps of pig-iron to the "Goat" mill, to see the Bessemer process of manufacturing steel rails. This was the great attraction of the day. This process, we understand, has not been tried in any other works besides Dowlais, and there was a general desire to witness it. It would be useless attempting a description of it to the non-professional, and those connected with the trade are too well acquainted with the process to require any. A personal inspection is essential before a correct idea can be formed. The molten iron is poured into an egg-shaped vessel, called the "converter," with the bottom of which there is a communication with a powerful blast-engine. When the vessel is charged with the proper quantity the steam is put on, and blows with such force, producing a white flame of such intense heat, as to strike the beholder with astonishment, and even terror. It is a boiling cauldron, from which the iron overflows like flakes of snow. The iron is then poured into square-shaped vessels in the proportion of from 10 to 12 cwts. each. These are called "ingots," and are afterwards taken into a furnace, and then put through powerful rolls. They are then cut in two, and made into rails in the ordinary way. About 500 or 600 tons of steel rails are made every week at these works.

The party then proceeded through the other portions of the works, and spent some time in witnessing an improved process for rolling, known as "Wyld's patent," by which a large saving of labour is made. It was most interesting to watch a boy conducting a large piece of iron, weighing 3 to 4 cwts., from one pair of rolls to another. When the rail was finished it passed over rollers moved by steam-power to where the saw was placed, and after being cut sent forward to the heap. The party then, at the invitation of Mr. Clark, proceeded to Dowlais House, where luncheon was served. The Duke of Devonshire, the Marquis of Bute, and many other distinguished men were among the number.

The Dowlais Works are, perhaps, the largest iron works in the world. They have 18 blast-furnaces, and all the necessary mills, furnaces, and other appliances for the manufacture of the enormous quantity of iron they produce. The company have also most extensive collieries, producing about 3000 tons daily, one-half of which is consumed at the works, and the other half shipped. A population of upwards of 20,000 is depending upon them. The Dowlais Works are the property of Sir Ivor Guest, and are presided over by Mr. G. T. Clark. The management is in the hands of Mr. Menelaus, the eminent engineer, and that gentlemen is assisted by an able and efficient staff.

In mechanical skill, and the maximum production for given quantities, Dowlais Works stands at the head of the iron trade. If there be any discovery in science, or means found for lessening the cost of production, it is sure to be tried at Dowlais. It appears as if ingenuity and human skill and labour could not be carried further than they are to be seen here. We could not, however, help contrasting the appearance of these works with what we witnessed at Cyfarthfa. There is an air of stability and permanency about Cyfarthfa, as if the works were intended to last for ever. The visitor was impressed with the idea that there was something in view besides the mere making of money. The lofty and roomy mills, and the ample space afforded for every branch of the manufacture, showed that the health and comfort of the men were not entirely disregarded.

### THE STEEL AND COPPER WORKS AT SWANSEA.

The visitors arrived at the Landore Station by special train from Merthyr, and at once proceeded to inspect the Landore Siemens' Steel Works, adjoining. They were met at the station by Mr. Gordon, the managing director of the works, Mr. W. Richards, one of the directors of the company, and Mr. Hackney, works manager. Mr. Siemens, one of the principals of the company, accompanied the members from Merthyr, he having read a paper there the day previous "On Pyrometers." The President of the Institute, the Duke of Devonshire, was also present, and amongst the visitors, who numbered upwards of 150, were Mr. Fothergill, M.P. for Merthyr; Mr. H. H. Vivian, M.P.; Mr. G. T. Clark, manager of the Dowlais Works; Mr. Jenkins, cashier of the works; Mr. Crawshay Bailey, and the principal ironmasters of South Wales; among the visitors being the principal ironmasters in the United Kingdom.

The steel works were formerly used as silver works by Messrs. Dillwyn, Richards, and Co., at Landore, but about two years ago they were adapted to the production of steel by Siemens' patent, and are now doing a flourishing trade, extending at every point. The staple of the works is steel rails, for which there is great demand, the Great Western Railway Company alone being capable of taking all that can at present be produced at the works.

The process of manufacture is simple. Hematite pig-iron is passed through puddling-furnaces heated with gas at a high temperature. From these the iron is taken to steel-melting furnaces, where it is made liquid, and cast into ingots. These are conveyed in a heated state to a steam-hammer, weighing 8 tons, each ingot being 12 tons 2 qrs. in weight. They are compressed by this means, then cut in pieces, and passed through iron rollers till they are attenuated to the necessary length and shape, when the ends are cut off by means of a circular saw while still at red heat, and the rail is finished.

The smelting and heating are all carried on by means of gas. There are 24 gas producers at present in full work, and 24 more are in process of construction. The gas is generated from one-third binding coal, for which 5s. 6d. per ton is paid, and two-thirds free burning coal, which costs 3s. 9d. per ton. Samples of the combustibility of the gas were shown to the visitors.

The mode of testing the rails is by means of a heavy blow from a hammer, or "monkey," suspended at heights varying according to the necessary test. In the present case a rail was placed across, and a hammer, 18 cwts., was allowed to fall from a height of 24 ft. In the first test the rail was broken in two, but in the next it was bent only, and a second blow from the "monkey" straightened it again. There was not the slightest shadow of a fracture from the strain on the metal, and the test was pronounced by all present to be particularly satisfactory in every respect. It may be stated that the test required by the Great Western Railway is that of the same weight falling from an altitude of 6 ft. only.

The various processes of manufacture were carefully explained by Mr. Siemens, Mr. Gordon, and Mr. Hackney, and were viewed with interest by all present. Some specimens of steel wire were also shown to illustrate the toughness of the steel. Wire, of the diameter of the stem of a tobacco-pipe, was found tied in knots of all shapes, and twisted spirally into the smallest possible circumferences. Not the slightest indication of a fracture was visible anywhere.

### THE HAFOD COPPER WORKS.

Having inspected the steel works, the party proceeded to the Hafod Copper Smelting Works of the Messrs. Vivian and Sons, where the several processes of smelting were fully explained by the principal of the works, Mr. Hussey Vivian, M.P., who accompanied the visitors. The Hafod Copper Works are among the largest in the world, giving employment, inclusive of the rolling-mills, to upwards of 1000 workpeople. The Duke of Devonshire and the members of the Institute manifested a lively interest in the various processes, explanations in reference to which were given by Mr. Vivian, the party being accompanied by Mr. Wm. Morgan, manager of the works, and Mr. Hermann, both of whom also explained some of the intricacies of the handicraft which has for years been the staple of the district. The inspection of the works having been concluded, by an arrangement made by Mr. Joshua Williams, a special train drew up to the siding, and the party went on to Swansea to partake of the Mayor's hospitality.

[Invitations had been issued by the Mayor to the principal merchants and others in the neighbourhood, and each member of the Institute had also been invited by his worship to take luncheon at the Mackworth Arms Hotel. Upwards of 250 sat down, the large dining-hall being well filled. The Mayor presided, and the spread was on the most liberal scale, being served up in a way the mere mention of which has now become superfluous in connection with this admirably conducted hostelry.]

Leaving Merthyr at an early hour the Monmouthshire Works were visited. The special train passed over the Crumlin Viaduct, which was the object of especial admiration, and by way of Llanhilleth junction and the Monmouthshire Railway, the party reached Ebbw Vale. At Ebbw Vale the Bessemer process is in operation, and a considerable extension of the steel works is in progress. Much interest was shown in the inspection of the Bessemer Works. After the excursion the members repaired to the Victoria Park, Ebbw Vale, where a splendid luncheon was provided for them by Mr. Abraham Darby, the managing director of the Ebbw Vale Steel, Iron, and Coal Company (Limited). The usual toasts followed the luncheon, and Mr. Darby's health was drunk with enthusiasm. This concluded the visit of the Institute to the district; and, according to general opinion, it has proved one of the most important and interesting gatherings held since the establishment of the Institute.

## The Royal School of Mines, Jermyn Street.

### MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE LV.—It is obvious (said Mr. SMYTH) from what I have already shown you that by means of proper stoppings and doors the air is easily carried from the downcast shaft through every portion of a mine until it reaches the upcast shaft. Many years ago that mode of conducting the current universally prevailed, but it had this great inconvenience attending it, that it carried all the gases and impurities it met with in its "excursions," until towards the end of its journey it might be almost too foul to breathe, or fearfully explosive, and when the returns were carried through the furnace a constant danger was incurred. This mode of ventilation was in use at the Lundhill Colliery in 1857, when an awful explosion took place, by which 189 lives were lost, and it is yet in use in many places. Many years before, however, the mine managers and Northern viewers recognised the importance of shortening the runs of the air, as well as attaining large volumes. I may mention first, however, that in carrying the currents of air through a mine it is repeatedly necessary that they should cross each other, and this is done by means of what is technically called a "crossing." These are made in a variety of ways. Sometimes in small collieries, when the intake stream comes to the outgoing current the latter is blocked off, and is made to pass over the other in a small trough; but that is a most obectionable plan. First of all, it contracts the area through which the intake air comes in, and, on the other hand, by sending the return air through so small a space its velocity is checked—and, besides, it is greatly liable to accidents from the trucks running against it. In large collieries, worked on scientific principles, and with adequate means, such a plan is not allowed to be even thought of. A more common way is to carry the return air-way of the full size over the other; but, in this case, if an explosion broke the arch the intake air would be spoilt. A system of crossing, therefore, has now been introduced which is proof against explosion, by which the outgoing current crosses at a considerable height through the measures, and so a strong partition of solid ground is left between it and any danger which may arise in the air-way below. When this is done, the rise must be commenced at some distance, so that it may not be too abrupt. This system is expensive, and not as yet very common. Another plan is that of making the crossing of boiler-plate iron, rivetted together like a boiler, which gives it a greater tenacity and power of resistance, sufficient probably for small explosions; but it is not greatly depended upon in the case of great explosions.

Resuming the subject of distribution, Mr. SMYTH said that about the year 1760 Mr. Spedding, a mining engineer, introduced the plan of "coursing" the entire works. It was well known that accidents occurred in and by means of large spaces of dead workings, and he proposed to take the air through the whole of them, and sweeping up all the deleterious gases by two-and-two passages, and then coming together again, or sometimes by three-and-three, and then brought together again. By these means, and according to the scale on which a colliery is worked, the air had to pass through an immensely great length of drifts, and the result was that at the beginning of this century the distance the air had to travel in some collieries was 20 or 30 or, in some cases, 40 miles. The consequence was that which I have just mentioned, that at the end of its course the air was neither fit to be breathed by the men nor fit to encounter open lights. By this system a person going into a mine, and finding at the starting a fine current of pure air, might think the ventilation satisfactory; but as such a visitor progressed, and found his way into the return air, he would find it exceedingly hot, foul, and noxious, and in collieries liable to fire-damp not a little dangerous. Attention was much directed to these facts, when, principally through the agency of Mr. Buddle, a great colliery viewer of the North of England, a system of splitting or dividing the air into shorter runs was introduced, proving one of the greatest improvements ever brought into practical ventilation as applied to mining. This was done by dividing the intake air at the bottom of the shaft, and sending each division into a separate district or panel, as it is sometimes called, of the mine. Thus, supposing the whole length of the workings and drifts to be 40 miles, and the air at starting to be divided into four parts, it is obvious that each division would traverse 10 miles only, instead of the whole passing through the entire 40 miles, as under Spedding's plan. An objection was raised on the ground that the supply of air would be insufficient, but a little calculation showed that the apprehension was groundless, the shafts being invariably larger in superficial area than the drifts. Thus, it is evident, if we have a shaft of only 10 ft. in diameter, that that will give an area of 75·5 square feet, and the ordinary size of the drifts being 5 ft. wide by 6 ft. high, that will give an area of 30 square feet—so that it is clear

the ventilating supply of such a shaft is capable of dealing with two, if not three, separate sets of drifts or splits; and the upcast shaft can always pass more than the downcast. If a shaft be 30 ft. in diameter, its area is 176·7, and it will give the power of making half-a-dozen splits. The mode of carrying out this system is extremely simple. Suppose a colliery, divided into four districts or panels, by putting in permanent stoppings where requisite for that purpose, the main current is divided near the shaft into two parts, and then a little further on each part is again divided. Each of the four currents then passes round the panel into which it is directed, and on its return it is conducted into a general return air-way leading to the upcast shaft, either by a dumb-drift, such as I described in a former lecture, at a certain height above the furnace, or, if there are no explosive gases, through the furnace itself. There are comparatively few collieries now in which the air is not split into two divisions, right and left of the pit bottom, but in the larger collieries the splits are more numerous—sometimes a dozen or more—and they are managed with great skill and efficiency. This splitting of the air is applicable to any system of working, but in opening new workings Mr. Buddle's plan was to divide them by leaving large and strong ribs of coal—so that when an explosion did take place it might be confined to the panel in which it took place. Splitting the air has not entirely prevented explosions—probably that will never be accomplished—but it has greatly lessened them, and it certainly indicates the proper direction in which to look for the diminution of these sad catastrophes. Thorough ventilation is the best preventive, and cases are known in which the miners could not work without safety-lamps, and even then at the peril of their lives every moment, where by thorough ventilation it is now quite safe to work with naked lights. This system, moreover, does not involve a necessity for more shafts; but, as a colliery extends its underground workings year by year, it should be remembered that the power of a single shaft to supply pure air has its limits, and when those limits are reached another pair of shafts should be sunk. I may just add that the area of each panel, if about the same, facilitates the ease with which the splits are managed, but that it is quite possible to ventilate any particular area which is more productive of fire-damp than another by a split to itself, although that area may be smaller than the others.

Before I refer (and I propose to do so in my next lecture) to certain natural laws which regulate the movements of bodies of air, and which it is important to understand if we would apply our ventilating power to the greatest advantage, I ought to mention that in Belgium and in Prussia a system is in use which is made compulsory by the law of the land. It is called the "Ascensional System," and by it the air must be carried first to the deepest part of the workings, and then upwards through the workings, and out by the shortest shaft. [MR. SMYTH then, by drawings on the board, illustrated the system, and showed various circumstances in which the ascensional system was not the best, although, in many respects, it had advantages.] Some English capitalists, who were working a mine in Prussia, were a few years ago subjected unnecessarily to a great expense by the necessity of complying with the ascensional law. The official inspectors insisted on a drift being carried from a deep portion of the workings direct to the upcast shaft, whereas it would have been a perfectly efficient ventilation, in the opinion of English engineers, to have taken the air downwards to the workings in question, and saved all the expense of the drift, which was useless for any other purpose. In this particular case the drift was carried into the upcast shaft at a higher point than the other workings, and, therefore, cut off a portion of the column of heated air therein, and reduced its ventilating power. The object of all these laws and systems is to lessen the danger of explosion, as well as to supply purer and better air to the workmen; but when everything is done that can possibly be done there will always remain some risk. A mine may be thoroughly well ventilated, and the men may work in safety and comfort 364 days in the year, but in the 365th the stroke of a pick may release a pent-up magazine of explosive gas, and a terrible catastrophe may ensue. The loss of life may be reduced by the adoption of the panel system, which I have described in connection with that of splitting the air, but attention might be advantageously directed to overcoming the dangers of choke. In every explosion by far the greater number of lives is lost by that. The scorching blast may not reach from the point of explosion, but the deadly choke-damp extends far and wide. At the Risca Black Vein Colliery, some years ago, an explosion took place, by which many lives were lost; but the bodies of many of the victims were found several hundreds of yards from the explosion unscathed by fire, and some were evidently fleeing for their lives, when they could no longer hold out against the choke-damp. It is, therefore, a matter for consideration whether a safety drift could be constructed through which a current of fresh air should always be passing, so disconnected with the workings as to render its demolition unlikely, if not impossible, and to which the men might escape after an explosion, instead of having, perhaps, a mile between them to the bottom of the shaft. Such a device, if found to be practicable, would undoubtedly be the means of saving many lives.

## PERPETUAL MOTION.

The search for perpetual motion has probably cost more men their fortunes than any other phantom which has been pursued; yet it is difficult to find anything more interesting than the account of the labours of those who have devoted themselves to the performance of mechanical impossibilities. Hence the volume* by Mr. DIRCKS, containing his second series of researches into the history of perpetual motion seekers, will be undoubtedly read with much pleasure by a large number of persons. The author remarks that until recently it was thought that the history of the search for self-motive power dated no further back than the sixteenth, but we now trace it to the thirteenth century, thus including three centuries when the publication of mechanical invention was almost unknown, except among those of the noble and wealthy to whom the inventor might happen to apply for patronage. Mr. Dircks very truly suggests that no doubt the Marquis of Worcester's wheel, and the subsequent publication, Orffyreus's weight-raising wheel at Cassel, have gone far to encourage a certain class of sanguine but shallow inventors to search for the presumed-to-be-lost principle of those alleged weighted and moving wheel machines. The weight of evidence, he says—and this no one can doubt—is decidedly opposed to a belief in the possibility of realising an artificial perpetual motion. A very slight acquaintance with the immoveable mechanism which skilless mechanics have produced for centuries, down to the present time, might serve to satisfy any but the most stupid and impenetrable intellects that, unless some undiscovered law of Nature can be developed, perpetual motion must be doomed to remain an impossibility.

These extracts will suffice to show that Mr. Dircks is no believer in the artificial production of perpetual motion, so that inventors may feel confident that they will not be led astray by the perusal of his work; and the careful study of it cannot fail to instruct as well as amuse. After narrating the early opinions respecting the possibility of and projects for obtaining perpetual motion, he describes the inventions of the Marquis of Worcester and Councillor Orffyreus, the patents of the 17th and 18th centuries, and the early papers from the Philosophical Transactions and Paris Academy of Sciences. Next follow some valuable remarks on perpetual motion, principally derived from treatises on natural philosophy; references to early scientific and other journals; definitions and descriptions of perpetual motion from encyclopædias, dictionaries, and other sources. As to the completeness of Mr. Dircks' researches upon the subject, there can be no question, and in reply to the question—"Of what use can our labour be when the labours we record are in themselves entirely useless?"—with which he commences his preface, few will hesitate to say that its utility is enormous, for he has shown that, no matter what the formation of the machine may be, the result is invariably the same—disastrous failure. He has shown that theoretically the creation of perpetual motion by artificial means is impossible, and that the most strenuous efforts of experimentalists to prove that theory averse to practice have failed. Mr. Dircks' work is well entitled to extensive patronage, and from the interest felt in the subject it will, doubtless, obtain it.

* "Perpetuum Mobile; or, a History of the Search for Self-Motive Power, from the Thirteenth to the Nineteenth Century." By HENRY DIRCKS, C.E., LL.D.—London: E. and F. N. Spon, Charing-cross.

THE WIRE TRAMWAY IN CALIFORNIA.—We learn from Treasure Hill, White Pine district, that it has been decided to introduce the wire tramway, invented by Mr. C. Hodgson, and to which reference has frequently been made in the Journal, for the carriage of ore from the mines at Treasure Hill to the company's mills. The line will offer an excellent opportunity for judging of the merits of the system; and if the confident anticipations of the miners and millmen there be realised the wire tramway will soon be more common on the mines of America than in those of Europe.

DŒRING'S BORING MACHINE.—We hear that Mr. Dœring's boring machine is now at work in the 270, 290, and 266 fm. levels at Dolcoath, and has driven 14 ft. 9 in. in four weeks, at a cost of 22*l.* per fathom. The ground here is hard indeed, and would be worth in the ordinary way of driving 25*l.* per fm. Mr. Dœring has already three machines at work, and will have a fourth in the course of a week or two. Of course there are still local prejudices to contend with, but not on the part of the agents. These are, however, rapidly passing away. It is satisfactory to learn that for sixteen weeks the Dolcoath machine was not required to stop one moment for repairs. In fact, there has been no breakdown of any kind for some time.—*West Briton.*

THE ALUM WORKS' CHIMNEY.—During the last 12 months the large chimney at the Goole Alum and Smelting Company's Works has been subsiding, owing to the intense heat from the furnaces, until it became about 4 ft. out of perpendicular. The chimney, which is a very handsome erection, is about 200 feet high, consequently, in subsiding to such an extent, it assumed a very dangerous aspect; and it was only a question of time as to when it would pass the centre of gravity and fall. Mr. J. Berger Spence determined, a short time ago, to bring the chimney back again to its original position, by cutting out a layer of bricks, about two-thirds of the way round, and about 20 feet from the base. When this layer of bricks had been taken out, strong iron wedges were introduced, and a thin layer of bricks put in the place of the course of bricks extracted. When this had been accomplished, the wedges were then drawn out, and the stupendous structure came over with crushing weight on to the new-made bed, assuming its original position. The plan which has been adopted, although very dangerous, has proved perfectly successful; and the calculations have been made with such nicety, that no one can detect a flaw in the chimney.

MINING ENGINES.—Messrs. M. Baird and Co., of the Baldwin Locomotive Works, Philadelphia, have built during the present year a number of small locomotives for use in mines, hauling away cinder, &c. The engines referred to are miniature locomotives, adapted to narrow gauges of 2½, 3, or 3½ ft. The Thomas Iron Works, Hokendauqua, the Lehigh Crane Iron Works, Catasauqua, and the Glendon Iron Works, Easton, are each now working two of these machines for hauling away cinder from their furnaces. At the former establishment the two engines do the work which formerly required thirty mules. The economy of their use is, therefore, manifest. For out of door work the little engines are built with outside cylinders, 9 in. diameter and 12 in. stroke; the driving wheels are 30 in. diameter. For mining purposes the cylinders are placed inside, the extreme width is reduced to about 5 ft., and the extreme height to 5 ft. 4 in. When running in the heading of a mine it is intended that coke shall be used as a fuel, so that little or no smoke or gas will be produced. These engines, in complete working order, with tank of water on boiler, and a man on the footboard, will weigh only six to eight gross tons.—*Pottsville Mining Journal.*

## FOREIGN MINING AND METALLURGY.

The Charleroi Chamber of Commerce has issued its report for 1869. This important document affords a good deal of interesting information on the coal mining and metallurgical industry of the Charleroi basin. It appears that the coal production of the basin amounted in 1869 to 5,496,720 tons, or 234,908 tons more than in 1868. In 1868 the advance made upon 1867 was only 44,030 tons, and in 1867 the progress realised over 1866 was only 14,018 tons. In ten years the coal production of the Charleroi basin was increased to the extent of 1,947,488 tons, and yet the number of workings in activity declined from 135 in 1859 to 101 in 1869. It will be inferred—and inferred correctly—that a great development has been given to the workings, which have been maintained in activity, and that their productive power has been considerably increased. Thus in 1859 the engines used in the coal mines of the basin for purposes of extraction, drainage, and ventilation represented a collective force of 14,943 horses; in 1869 similar apparatus had a collective force of 18,123 horses. The number of workmen employed in the Charleroi basin, which had diminished in 1868, experienced a still further decline in 1869. In 1868 the coal mining interest of the Charleroi basin employed 35,689 men, whilst last year the number had sunk to 34,212, showing a falling off of 877. The force of the engines employed increased, comparing 1869 with 1868, to the extent of 1420 horses. The past year is considered to have been rather an unprofitable one for the coal workers—that is, the profits were rather below the average.

There is not much to be said of the Belgian iron trade this week. The Chambers have adopted a bill authorising the Government to treat with the works with regard to new orders instead of having recourse to public adjudications. Nevertheless, the Government proposes to dispose by public tender next month of old rails taken up from the State lines. The old rails may be exchanged for new ones, or money may be paid for them. The Bill just adopted by the Chambers does not authorise the Government to give out orders for more than 15,000 tons of rails—no great amount after all. The Coal Basins of the Hainaut Railway Company have undertaken to construct about 375 miles of line on account of the State, and it is urged that this work might be advantageously taken in hand at the present juncture. No doubt it might from an ironmaster's point of view, but in the present troubled state of affairs no one—not even a Government—seems disposed to launch out further than can possibly be helped. The aspect of the Belgian coal trade has not experienced any material change. The longer the war lasts the more affairs languish, and the more the situation becomes grave. The deliveries made to France are almost *nil*, and this state of affairs threatens to be prolonged. Belgian coalowners have only a few orders on foreign account, and the home consumption is not at its highest level, so that coalowners are accumulating stocks.

Advices from the departments of the Haute-Marne and the Moselle almost make default, and no wonder, communications being interrupted, and the whole district being in the hands of hostile Germans. In the present unhappy state of affairs it is, of course, extremely difficult to say what may happen, but at present the works have not suffered, and if some of them have been stopped it has been rather from considerations of prudence than from absolute necessity. Nothing can be said as to current prices, since nothing (or almost nothing) has been done. The Paris iron trade is completely disorganised; business is almost entirely neglected, and the great preoccupation of the moment is the public defence. An iron suspension bridge is about to be thrown over the River Herault, between the communes of Gignac and Langamas, in the department of the Herault. By an official decree of July 13, Baron d'Adelsward, forgemaster, of Longwy, has obtained a concession for the working of hydroxided oolitic minerals at Herserange. The concession comprises a surface of about 866 acres, in the arrondisement of Briey, in the department of the Moselle. The annexed table shows the imports of iron minerals into France in the first six months of this year, as compared with the corresponding period of 1869:—

| Source of supply. | 1870. | | 1869. |
|---|---|---|---|
| Belgium ..... Tons | 58,639 | ..... | 60,727 |
| German Association ..... | 57,433 | ..... | 39,956 |
| Spain ..... | 55,974 | ..... | 39,917 |
| Kingdom of Italy ..... | 24,873 | ..... | 28,452 |
| Switzerland ..... | 342 | ..... | 217 |
| Algeria ..... | 86,158 | ..... | 108,228 |
| Other countries ..... | 1,553 | ..... | 1,289 |
| Total ..... | 284,972 | | 278,786 |

The imports of minerals into France have thus, it will be seen, remained nearly stationary. There has been a sensible increase in the quantity of minerals received from Spain and the German Association or Confederation; this augmentation has been, however, almost annulled by the notable diminution experienced by the imports from Algeria.

The continental metal markets are sorely tried by the war. Transactions are limited to the immediate requirements of consumption, and everywhere commercial men are ardently longing for peace, although, even if peace should be soon concluded, industry would have a great deal to do to overcome the trials which it has had to sustain for some time past. At Havre, Chilian copper in bars has made 64*l.* per ton; ditto in ingots, 73*l.* per ton; Peruvian mineral, 70*l.* to 70*l.* 10*s.* per ton; United States (Baltimore), 76*l.* to 78*l.* per ton; ditto (Lake Superior), 80*l.* to 86*l.* per ton; ditto Mexican and La Plata in bars, 66*l.* to 68*l.* per ton. The autumn tin sale of the Dutch Society of Commerce is announced; it will comprise 80,000 ingots of Banca. The society also announces that no other sale of tin will be made by it, either in Holland or in the Dutch Indies, before the spring of 1871. Banca is quoted at 75 fls., and Billiton at 73 fls., at Rotterdam. There is no material change to report in lead or zinc.

## FOREIGN MINES.

ST. JOHN DEL REY MINING COMPANY (Limited).—Advices received August 27, *via* Bordeaux, ex steamer Amazine.

*Morro Velho, July* 29.—GOLD EXTRACTED TO DATE.—The produce from the mineral treated in the stamps during the second division of the month, being a period of 11 days, amounts to 2855 oits.—viz.:

| | Oltavas. | Tons of stone. | Oits. p. ton. |
|---|---|---|---|
| From General mineral ..... | 1684·0 ..... | from 881·8 = | 1·909 |
| From Gamba ditto ..... | 811·8 ..... | ,, 380·7 = | 2·132 |
| From Cachoeira ditto..... | 360·0 ..... | ,, 262·7 = | 1·370 |
| Total ..... | 2855·8 | ,, 1525·2 = | 1·872 |

Recovered from waste sand, Lyon, 36·8 oltavas.

The yield from the General mineral is one-fifth of an oltava better than the previous division gave, nearly seven-tenths of an oltava higher from the Gamba mineral, but it is also seven-tenths lower from the Cachoeira mineral. That obtained from the West Cachoeira contains very little pyrites at present.

The General standard is nearly one-fifth of an oltava better than we extracted in the previous division. The last division of this month will, I hope, show a little better produce.

Advices received Sept. 12, 1870, dated Morro Velho, Aug. 1:—

SINKING OF SHAFTS.—I am now enabled to advise you of the sinking effected at the new shafts during the month of July just ended. A shaft has been sunk 4 fms. 4 ft. 8 in.; B ditto, 5 fms.; making a total sinking of 9 fms. 4 ft. 8 in., or nearly 10 fms. in the two shafts, which may be considered as very good duty, bearing in mind the tough, hard, and unfavourable layers of mixed quartzose and pyritic rock passed through, especially in shaft A. The total depth of the shafts at the end of July is as follows respectively:—A shaft, 73 fms. 5 ft. 1 in.; B shaft, 73 fms. 2 ft. 4 in. We commence August with pretty fair ground in the sumps, though there are still portions of the quartzose layers visible in the bottom of the A shaft.

Advices received Sept. 14, *via* Southampton, ex Douro steamer.

*Morro Velho, Aug.* 17.—GENERAL OPERATIONS: The general work done during the first two weeks of this month has been carried on steadily, both in the mines, the new shaft, and at surface. The weather continues favourable for the latter work—water-courses, wheel-pits, &c.—and some very fair progress has been made in advancing them.

PRODUCE.—The gold extracted during the month of July amounts to 8678·8 oits. It has been derived as follows:—

| | Oltavas. | Tons. | Oits. p. ton. |
|---|---|---|---|
| From General mineral ..... | 4653·3 ..... | from 2391·0 = | 1·946 |
| ,, Gamba ditto ..... | 2149·4 ..... | ,, 1076·7 = | 1·995 |
| ,, Cachoeira ..... | 1142·8 ..... | ,, 700·2 = | 1·632 |
| Total stamps ..... | 7945·5 ..... | ,, 4167·9 = | 1·906 |
| From Arrastres ..... | 521·6 ..... | — = | 0·125 |
| Praia ditto ..... | 211·7 ..... | — = | 0·051 |
| Total ..... | 8678·8 | 4167·9 | 2·082 |

This produce, I am sorry to report, is 367 oits. less than was obtained in June, and a lower standard yield of 3-10ths of an oltava per ton. There has been nearly 4000 tons more mineral reduced. The decline in the yield is in the East Gamba and Cachoeira ores. The West Gamba mineral is treated in the General stamps at present, and, therefore, its quality is not as yet separately shown.

COST AND LOSS.

| | | |
|---|---|---|
| The produce for July being ..... | 8,678·8 oits. | |
| Less loss in melting into bars ..... | 19·4 | |
| Total ..... | 8,659·4, at 7s. 9d. per oit. | £3355 10 4 |
| Cost—Labour ....Rs. 28,572 $443 | | |
| Other charges....Rs. 19,736 $740 | | |
| Rs. 48,309 $183, at exchange 22¼d. per milrei .... | | 4478 13 3 |
| Loss in July on working ..... | | £1123 2 11 |

FERNAM PAES ESTATE.

| | |
|---|---|
| Outlay in July at Gaia Rs. 605 $450, at 22¼d. per milrei ..... | £ 56 2 7 |

NEW SHAFTS AND SURFACE WORKS.

| | |
|---|---|
| Total expenditure in July Rs. 13,430 $ 355, at 22¼d. ..... | £1245 2 1 |

The cost at Morro Velho is nearly the same as the previous month in sterling, owing to the more favourable rate of exchange, though it is two contos of reis more in current money. The increase is in labour, having a greater number of working days in July. Prices in a few articles, such as oil, candles, and pork, have been rather higher, but others have been more favourable, so that our outlay for provisions and bread stuff has been moderate. The sterling cost is very little above the average, but the lower produce for July, I am sorry to say, has caused a heavy loss on the working account.

The GOLD TROOP was dispatched per Juiz de Tora, to-day, *en route* for Rio de Janeiro, with four boxes containing 12 bars of gold, weighing in all 17,657 oits., equal 169·639 lbs. troy, with instructions from the agents to ship it per Douro, for Southampton.—N.B. The vessel having arrived the gold was duly delivered at the Bank of England.

DON PEDRO.—Mr. F. S. Symons reports for July: Produce, 6861 oits., at 8s. 6d. per oltava, 2915*l.*; cost, 2921*l.*; loss, 6*l.* Operations have been carried on steadily, and attendance has been good. The produce (notwithstanding being debarred from our richest stopes through water) is in excess of that for June. Although at Alice's west we have made no rich discovery, there are signs of improvement at No. 6. We are straining every effort so that the water-wheel to relieve animals for engine shall be ready by end of August or beginning of September; when at work many of our present difficulties and a heavy cost will cease.—Extract from letter dated August 17: The health of the force is good; attendance has not been quite up to the average, owing to saints' days. The produce is better than for first division of last month, owing to line in No. 6 having improved and given some box-work; it is, however, small, and when last worked on had again fallen off. No lode is now broken from bottom of mine, owing to water. Produce weighed to date, 3344 oits. The vessel containing the permanent pumping machinery has arrived safely in Rio, and is discharging her cargo.

TAQUARIL.—Mr. T. S. Treloar reports for July: After many vexatious drawbacks, entailing necessarily the exercise of a good deal of patience on the part of all connected with the undertaking, we have at last had ocular demonstration of some of the riches of Taquaril, and I can now assert, with every degree of confidence, that the company have indeed a brilliant future in store. Several rich veins, varying in thickness from 2 in. to 3 ft., and in width from 3 in. to 6 ft., as well as a bed of auriferous jacotinga, have been met with, and nearly all the crushed matter to date removed from old workings, amounting to about 75 tons, shows gold, a circumstance which augurs well for the general yield of the lodes. Through want of proper means for treating the stone, we have been unable to do other than merely extract as much of the shoots as could be pulverised in a mortar. In this manner 6 tons of stuff has been treated; and when I state that the same yielded 185 ozs. troy of gold, both directors and shareholders will, I feel sure, endorse the opinion of all parties here, that this mine is one of the richest in Brazil.

GENERAL BRAZILIAN.—Capt. T. Treloar reports for July: I am pleased to report that our operations generally have proceeded satisfactorily. We are not yet extracting gold, nor must it be expected. Time must be allowed for opening the mine, but gold will come by and by in such quantities as will not fail to be gratifying. Towards explorations not much has been done, as the hands are required at the adits. Pushing on the latter, erecting houses, cleaning rigos, and making roads are yet of primary importance.

ANGLO-BRAZILIAN.—Mr. F. S. Symons reports for July: Produce, 2874 oits., at 9s., 1293*l.*; cost, 1592*l.*: loss, 299*l.* Attendance has been above the average, and works have been carried on in the usual regular manner. Produce exceeds that for June, though not sufficient to show a profit. Appearance of mine presents little alteration. On the whole, the lodes are larger, and with a trifling improvement in standard we shall be enabled to show fair profits.

ROSSA GRANDE.—Mr. Ernest Hilcke reports for July: The gold return for the month amounts to 1908 oits. Total cost for the month, 1065*l.*—Operations: The operations have been somewhat retarded since my last, owing to the low number of native attendance. In Mina de Serra since the beginning of the month the force has been set to work for exploring the ground west of the shaft. At all the points we find the lode small and bunchy, but its quality highly auriferous; 106 tons of ore have been extracted and treated from these places, and yield 1805 oits. of gold, averaging 17 oits. per ton. In Gongo Soco no visible change has taken place in the appearance of the jacotinga at Angove's level. We commenced examining the jacotinga at a gulley about 70 fms. further west, through which a small stream of water runs; the jacotinga in and at the vicinity of this stream will, by sampling, show some fine particles of gold, even up to the highest point of the stream; immediately below this point passes a belt of very promising-looking jacotinga, which circumstance leads us to believe that the gold derives its origin from this bed. Commencement has been made for exploring the jacotinga here. The gully contains two more beds of jacotinga, which will likewise soon receive attention.

CHONTALES.—The directors have advices dated Aug. 8. Remittances of gold for July 152 ozs., from 610 tons of ore; average yield, 5 dwts. per ton; value, $2103; cost for the month, $4199.—Mr. Belt reports: During the first half of the month we were greatly hindered by continuous floods, which rendered it almost impossible to work the upper parts of the mine. At the mill chinery a great part of our water-course was carried away on July 11, and it took several days to repair it. At the same time the value of the ore fell off in the lower level. In consequence we could only get down and stamp 610 tons July has always been an exceptionally wet month with us, and considering the our hands have been mostly employed in repairing damages and securing levels I do not attach much importance to the loss, excepting that it diminishes our already too small available funds. The weather, though still wet, is finer than it was, and the mine at all points is looking better again. All the damage occasioned by the floods has been repaired, and we commence the present month with better hopes. We have completed the important work of connecting the Trinidad and San Antonio mines. We are now bringing up the connection level 10 fathoms below No. 5 level, and sending the ore from it down through the Trinidad mine. The ore from the connection level is worth 6 dwts. per ton, and appears to be improving as we get eastward. We have already commenced to stope above it. We have commenced sinking a winze from No. 5 level, which we propose to carry on to meet the connection level, and ultimately to No. 6 level. The lode in the bottom of this winze is worth 6 dwts. per ton. The machinery is in good working order, and the health of the establishment satisfactory.

San Antonio.—Report for the month of July: No. 2 stope, in back of No. 1 level, west of Piper's shaft, has been stoped 60 varas: lode 1 ft. wide, worth 8 dwts. of gold per ton. No. 3 stope, in back of the same level, east of Piper's shaft, has been stoped 18¼ varas; lode 4 ft. wide, at present hard and poor. A stope in back of the deep adit level has been stoped 83¾ varas; lode 3 ft. wide, worth 4 dwts. of gold per ton. A level has been driven west of No. 2 rise, on the course of the lode, 11¾ varas; lode 3 ft. wide, worth 5 dwts. of gold per ton; this level is 46 ft. below the No. 5. The new connection level has been driven on the course of the lode 33¾ varas; lode for the last 25 varas 3½ ft. wide, worth 6 dwts. of gold per ton. We have put a tramway in this level, and commenced stoping the back, but very little has been done, therefore I cannot state the value of the same. We have commenced to drive a new cross-cut in the eastern part of the mine, which will give us backs of 22 varas, and I hope to cut the lode this month. I have taken samples from some of the old pits sunk on the back of the lode in this part of the mine, which will pay for taking away. The natives report this part to be worth 1 oz. of gold per ton. The deep cross-cut at St. Domingo mine has been driven 13½ varas; the ground a little harder than last month. A winze has been sunk 8 varas in the bottom of the No. 5 level, west of Piper's shaft; lode 3 ft. wide, worth about 6 dwts. of gold per ton. The rise in the Trinidad Mine has been holed to the connection level, which is now available for carrying the quartz to the tramway. Owing to the constant rain and the falling off of the Nos. 2 and 3 stopes I have not been able to supply the stamps with quartz, but I hope now to keep 12 heads constantly at work. The number of tons sent to the stamps for the month is 610, which I estimate at 5 dwts. of gold per ton; in all about 152 ozs. of melted gold.—JOHN TONKIN.

EXCHEQUER.—Captain Chalmers, Bullions, Aug. 17: During the week ending the 13th inst. the north drift at the 50, in the winze, was in 87 ft., the winze was down 77 ft., and two false sets of timbers put in. Three men worked three days and two men five days each on the "Accacia." Three men were employed six days each grading for a first-class ore dump. The "Accacia" tunnel is in 17 ft. Some good ore makes its appearance as we get back into the ledge at the 77.

BATTLE MOUNTAIN (Nevada).—W. Nancarrow, Aug. 23: Virgil Lode: The north drift from shaft is driven 84 ft.; the lode in the present end is 4 ft. wide, and, although not looking quite so well to-day as it did yesterday, still it is a real good lode, and most likely by to-morrow will look as rich as ever. The two stopes in the back of the 73 ft. level, both north and south of winze, are both looking well, and we are taking out a very fine lot of copper ore from both the stopes, and also from the north end. In driving the 73 ft. level south of shaft, the lode is still large (4 ft. wide), but without any change for the better since I wrote you last week.—Lake Superior: Nothing new in the lode since my last report.—Hallow's Lode: On this lode we continue to sink the shaft, and during the last two days the lode presents a rather better appearance; the lode is large—I do not know how large, as we have no wall either side. I broke some good stones of ore out of the bottom of the shaft yesterday, and, taking it all together, it promises to improve shortly. Messrs. Heilman Brothers and Co. have been the last week or two shipping ore. I think they have shipped not much short of 2000 sacks to Liverpool direct. Last Saturday 20 inst., I went down to the railway station and weighed and sent off to San Francisco, care of Heilman Brothers and Co., 1456 sacks from the Virgin, and 170 from Lake Superior: together, 1626 sacks; weight, 219,247 lbs., or in tons of 2000 lbs. 109 tons, 873 lbs. This Virgin ore is a prime lot, as good as we have ever sent away. I left at the station nearly 300 sacks on the same day (20th), and since then we have sent down 326 sacks more, all from the Virgin, and we have more in the ore-house, and some 600 more waiting for sacks. I think we took out of the mine last month (principally from the Virgin) 120 tons; this month (all from the Virgin) I think we shall take out upwards of 150 tons, as you will see as we go on developing the mines our returns are on the increase. I only wish the price of copper was good. The number of cars I sent down last Saturday was ten, and if I could have got them I would have sent two more, but if ships are plentiful I shall be able to send down 1000 sacks more next week.

AUSTRALIAN UNITED (Gold).—In addition to the particulars published in the Supplement to last week's Journal, we are requested to insert the following, the agent's report (Capt. Williams) to Mr. Kitto, on July 16, on the Duke of Cornwall Mine:—"Daukes' shaft is now 53 ft. below the 200 ft. level, and we calculate to open out a fresh level at 66 ft. We have passed through it sinking last month the western flookan, and the ground is much easier in consequence; in fact, I may state that the ground was better in the 200 ft. level than it was in the 133, which will account for the change in the lode. The average of the quartz we cut in the 200 ft. level was nearly 8 dwts. per ton, for a width of 20 ft. In rising above this level the yield fell off considerably. It is my firm conviction that we are on the top of a good shoot of gold in the 200 ft. level, from the fact that in driving on the course of the lode the gold was invariably better at the foot of the drivage than at the top. This fact, combined with the change of ground at the shaft in the bottom, convinces me that our next level will cut rich stone. In one of my past reports I stated my opinion that this mine would be second to none in the district. From the 200 ft. level downwards the ground had precisely the same peculiarities in the adjoining rich claim of Rowe Brothers; the deeper they sunk the easter the ground became, with a better average from the quartz. The quartz in their lowest level is now 78 ft. wide, and averages in excess of 1 oz. per ton at last crushing. I am glad to state that I have the fullest confidence in the future of this mine, the Duke of Cornwall. The yield of gold from the pyrites is not so good as hitherto, owing to our working the sand much further away from the discharge shoots of the batteries."

[For remainder of Foreign Mines see to-day's Journal.]

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